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GSP-1620 Satellite Data Modem.
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QUALCOMM Globalstar GSP-1620 Satellite Data Modem Product Specification

80-99240-1, Rev. D

February 15, 2001

Table of Contents

How This Specification Is Organized	xv
Notational Conventions	xvi
Abbreviations and Acronyms.....	xvii
Related Documentation.....	xxi
Cautions and Warnings	xxi
Globalstar Overview	1-1
Space Segment.....	1-2
Ground Segment.....	1-2
Coverage	1-2
Carriers.....	1-4
Distributors and OEMs for User Terminals	1-5
GSP-1620 Modem Overview	2-1
Packet and Asynchronous Data Service.....	2-3
Modem Application Characteristics	2-4
Typical Modem SCADA Applications.....	2-5
Electric Utility Industry	2-6
Oil and Gas Wells, Tanks, Pipelines, Offshore Platforms	2-7
Water Treatment Plants	2-8
Remote Inventory Management	2-9
Remote Security System Monitoring	2-9
Energy Management	2-9
Remote Banking and Retail Transactions	2-10
Agriculture	2-10
Aviation	2-10
Features	3-1
General Modem Features	3-1
Globalstar Satellite Service	3-1
AT Commands	3-2
Modes of Operation	3-2
Short Messaging Service (SMS)	3-2
SMS Alerts	3-3
SMS Message Field Information	3-3

SMS AT Commands	3-4
Globalstar Service Alerts	3-4
Service Status Message	3-5
Position Location Determination	3-5
Packet/Asynchronous Data Overview	3-6
Packet Data Service	3-7
Data Rate and Throughput	3-7
Networking Software and PPP Sessions	3-7
Interoperability with Different Operating Systems	3-8
IP Addressing for the GSP-1620 Modem	3-8
Dynamic IP Addressing	3-9
Fixed IP Addressing	3-9
Virtual Private Network Service	3-10
Dormant Mode Service	3-10
Roaming and Packet Data Service	3-10
Asynchronous Data Service	3-11
Data Rate and Throughput	3-13
Accessing Packet Data Over an Asynchronous	
Connection	3-13
Roaming and Asynchronous Data Service	3-13
AT Commands	4-1
AT Command Quick Reference Tables.....	4-1
Hardware Description	5-1
Modem Mechanical Description	5-1
Modem Board Layout	5-1
Modem Dimensions and Weight	5-4
Modem Antenna Connectors	5-4
Data and Control Ports	5-4
DTR/DSR Signal and Power On/Off	5-5
Control Port Signals	5-5
Data Port Signals	5-6
DB-25 Data and Control Port Pinouts	5-7
Diagnostic Port	5-9
DC Power	5-10
Surge Protection	5-11
EMI Filtering	5-11
Power Consumption	5-12

Power-On	5-12
Power-Off	5-13
Hard Power Reset	5-13
Grounding	5-14
OEM Installation of the GSP-1620 Modem	5-15
Modem Antenna Specifications	5-16
Antenna Dimensions and Weight	5-17
Antenna Depiction	5-17
Antenna Cable Specifications	5-19
Calculating Antenna Cable Length	5-21
Mounting Antennas at the Field Site	5-21
Mounting and Sealing Antennas on Flat Surfaces	5-21
Mounting and Sealing Antennas on Poles	5-22
Mounting Multiple Antennas	5-23
Environmental Specifications	6-1
GSP-1620 Modem Environments	6-1
Temperature/Humidity	6-1
Operational	6-1
Non-Operational	6-1
Thermal Radiation	6-2
Altitude	6-3
Operational	6-3
Non-operational	6-3
Vibration	6-3
Operational - Random	6-3
Non-Operational - Random	6-3
Operational - Sinusoidal	6-3
Non-Operational - Sinusoidal	6-3
Mechanical Shock	6-5
Operational	6-5
Non-Operational	6-5
Acoustic Noise	6-5
Digital Data Connector Durability	6-5
Applied Forces	6-5
Mating cycles	6-5
RF Connector Durability	6-6
Materials	6-6
Shipping	6-6

Dielectric Resonator Antenna (DRA) Environments	6-6
Temperature/Humidity	6-7
Operational	6-7
Non-Operational	6-7
Thermal Radiation	6-7
Icing/Freezing Rain/Snow	6-8
Altitude	6-9
Operational	6-9
Non-Operational	6-9
Vibration	6-9
Operational - Random	6-9
Non-Operational - Random	6-9
Mechanical Shock	6-10
Operational	6-10
Non-Operational	6-11
RF Connector Durability	6-11
Materials	6-11
Shipping	6-11
RF Certification/Restrictions	7-1
Certification.....	7-1
Federal Communications Commission (FCC)	7-2
European R&TTE Directive 1999/5/EC	7-2
RF Restrictions.....	7-3
Radio Astronomy Zones	7-3
GPS Interference Elimination	7-3
Radio Frequency Exposure Restrictions.....	7-3
Electronic Device Restrictions.....	7-5
Pacemakers	7-5
Hearing Aids	7-5
Other Medical Devices	7-6
Modem Integrator's Kit	8-1
Kit Components.....	8-1
What You May Need in Addition to the Kit.....	8-2
Warranty	9-1

Product Support 10-1

 QUALCOMM Globalstar Customer Service 10-1

 Technical Support Information10-1

 Order Fulfillment Information10-2

 Customer Service Website Information10-3

 Contacting QUALCOMM Customer Service10-3

 Contact information10-4

Specification SummaryA-1

List of Figures

Figure 1-1	Globalstar Coverage Availability	1-3
Figure 2-1	Conceptual Diagram of GSP-1620 Modem	2-1
Figure 2-2	Typical Modem SCADA Application Using Packet Data	2-3
Figure 2-3	Typical Modem SCADA Application Using Asynchronous Data	2-4
Figure 3-1	Asynchronous Data Call Components	3-12
Figure 5-1	GSP-1620 Modem Board Layout (Top View)	5-2
Figure 5-2	GSP-1620 Modem Board Layout (Side/ Bottom Views)	5-3
Figure 5-3	DRA Side View	5-16
Figure 5-4	DRA View Showing Connectors	5-17
Figure 5-5	DRA Top and Side Views	5-18
Figure 5-6	DRA Bottom View and Mounting Hole Locations	5-19
Figure 6-1	GSP-1620 Modem Temperature/Humidity Envelope	6-2
Figure 6-2	GSP-1620 Modem Random Vibration Spectra	6-4
Figure 6-3	DRA Temperature/Humidity Envelope	6-8
Figure 6-4	DRA Random Vibration Spectrum	6-10

List of Tables

Table 2-1.	Typical GSP-1620 Modem Applications	2-6
Table 3-1.	Packet vs. Asynchronous Data	3-6
Table 4-1.	Operational AT Commands	4-1
Table 4-2.	Non-Operational AT Commands	4-4
Table 5-1.	Interface Connector Pinouts	5-7
Table 5-2.	Modem DC Power Consumption Estimates at 12 V DC Input	5-12
Table 5-3.	Suggested RF Cable and Connector Suppliers	5-20
Table 6-1.	Swept Sine Vibration Definition	6-4
Table 8-1.	Checklist of Modem Integrator's Kit Components	8-1
Table A-1.	Specification Summary — GSP-1620 Modem	A-1
Table A-2.	Specification Summary — Dielectric Resonator Antenna (DRA)	A-2

Revision History

Version	Release Date	Notes
Rev. A	February 1, 2000	First specification (Microsoft Word format)
Rev. B	October 31, 2000	Second specification (Microsoft Word format)
Rev. C	January 2001	Removed “QUALCOMM Proprietary” (Microsoft Word format)
Rev. D	February 15, 2001	<p>Release to accompany GSP-1620 modem software version 5.2:</p> <ul style="list-style-type: none">■ Changed modem name and specification title (removed “packet”)■ Added information about asynchronous data, especially in Chapter 2 and Chapter 3■ Revised Customer Service information in Chapter 10■ Added modem and antenna specifications in new Appendix A■ Converted to FrameMaker format

About This Specification

This *QUALCOMM Globalstar GSP-1620 Satellite Data Modem Specification*, also referred to as the *GSP-1620 Modem Specification*, provides information about the QUALCOMM Globalstar GSP-1620 Satellite Data Modem, also referred to as the GSP-1620 modem in this document.

How This Specification Is Organized

This following table summarizes how information is organized in this specification.







Chapter	Description
Chapter 1. Globalstar Overview	Globalstar space and ground segments, coverage and carriers.
Chapter 2. GSP-1620 Modem Overview	A conceptual overview of the modem (including its ports and antenna), packet and asynchronous data service, and typical modem SCADA applications.
Chapter 3. Features	A discussion of general modem features, as well as features specific to packet and asynchronous data service.
Chapter 4. AT Commands	List of AT commands for the modem.
Chapter 5. Hardware Description	Description of the modem and antenna hardware, including mechanical descriptions, specifications, user interfaces, power requirements, and grounding.
Chapter 6. Environmental Specifications	Specifications for modem and antenna environments.
Chapter 7. RF Certification/Restrictions	Certification compliance and RF restrictions for the modem and antenna.

Chapter	Description
Chapter 8. Modem Integrator's Kit	Kit components and what you may need in addition to the kit.
Chapter 9. Warranty	QUALCOMM warranty information for the GSP-1620 modem.
Chapter 10. Product Support	How to contact QUALCOMM Globalstar Customer Service.
Appendix A. Specification Summary	Quick reference list of hardware specifications for the GSP-1620 modem and antenna.

Notational Conventions

The following table shows the notational conventions that convey specific types of information in this specification.

Convention	Description
Commands, parameters, values, filenames, directory locations	Items shown in <code>courier</code> typeface indicate commands, parameters, filenames, and directory locations.
<Non-literal elements>	Items shown within angle brackets and <code><courier></code> indicate non-literal elements for which you type a substitute.
Menu items and buttons	Menu items, commands, and buttons appear in bold sans serif .
Dialog box and window titles	Dialog box and window titles appear in bold sans serif .
<i>Book titles and section references</i>	Book titles and section references appear in <i>italics</i> .

Convention	Description
 Steps	A Steps symbol identifies a procedure. Follow these steps to accomplish a specific task.
 Note	A Note symbol identifies related information that deserves emphasis.
 Tip	A Tip symbol identifies a shortcut or information that you might find handy.
 Reference	A Reference symbol identifies a separate document containing related information.
 Caution	A Caution symbol identifies a potentially hazardous situation which, if not avoided, could damage equipment or property.
 Warning	A Warning symbol identifies potential danger, which, if not avoided, could cause serious injury or death.

Abbreviations and Acronyms

AC	Alternating Current
API	Application Programming Interface
AT	Attention
ATM	Automated Teller Machine
CCA	Circuit Card Assemblies
CDMA	Code Division Multiple Access
CDR	Call Detail Record
CD-ROM	Compact Disc Read-Only Memory

CE	Community European
CFR	Code of Federal Rules (FCC)
CP	Control Port
CTS	Clear To Send
DC	Direct Current
DCD	Data Carrier Detect
DCE	Data Communications Equipment
DM	Diagnostic Monitor
DN	Directory Number
DNI	Do Not Install
DNS	Domain Name Server
DP	Data Port
DRA	Dielectric Resonator Antenna (see ODU)
DSR	Data Set Ready
DTE	Data Terminating Equipment
DTR	Data Terminal Ready
EIRP	Equivalent Isotropic Radiated Power
ESD	Electrostatic Discharge
ESN	Electronic Serial Number
FAX	Facsimile
FCC	Federal Communications Commission
FDX	Full-Duplex
GAI	Globalstar Air Interface
GEO	geostationary-Earth-orbit
GLP	Globalstar Limited Partnership
GMT	Greenwich Mean Time
GND	Ground or Signal Common
GPS	Global Positioning System
GW	Gateway
HVAC	Heating, Ventilation and Air Conditioning

IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
ISP	Internet Service Provider
IWF	Interworking Function (Gateway)
LCD	Liquid Crystal Display
LEO	low-Earth-orbit
LNA	Low Noise Amplifier
MCC	Mobile Country Code
MCX	Miniature Coaxial Connector
MEO	medium-Earth-orbit
MIK	Modem Integrator's Kit
MNC	Mobile Network Code
MPE	Maximum Permissible Exposure
MSIN	Mobile Station Identification Number
MSS	Mobile Satellite System
NAM	Number Assignment Module
ODU	Outdoor Unit (see DRA)
OEM	Original Equipment Manufacturer
OSPL	Overall Sound Pressure Level
PC	Personal Computer
PDF	Portable Document File
PDT	Pacific Daylight Time
PLS	Position Location Service
POS	Point of Sale; or Position
PPP	Point-to-Point Protocol
PST	Pacific Standard Time
PSTN	Public Switched Telephone Network
PT	Pacific Time
QA	Quality Assurance
RF	Radio Frequency

RFR	Ready For Receive
RI	Ring Indicator
RLSD	Received Line Signal Detector
RMA	Return Material Authorization
RSSI	Received Signal Strength Indicator
RTS	Ready To Send
RTU	Remote Termination Unit
Rx	Receive
RxD	Receive Data
SCADA	Supervisory Control and Data Acquisition
SLIP	Serial Line Internet Protocol
SMA	Subminiature type “A” Connector
SMS	Short Messaging Service
SMT	Surface Mount Technology
SP	Service Provider
SPC	Service Programming Code
TCP	Transmission Control Protocol
TCXO	Temperature Compensated Crystal Oscillator
TSS	Technical Support Specialist
TTL	Transistor Transistor Logic
Tx	Transmit
TxD	Transmit Data
UCT	Universal Coordinated Time
URL	Uniform Resource Locator
UT	User Terminal
UTC	Universal Time Coordinated
UTPST	User Terminal Program Support Tool
VPN	Virtual Private Network
VSWR	Voltage Standing Wave Ratio

Related Documentation

Globalstar UT Program Support Tool User's Guide,
80-98225-1.

Globalstar User Terminal Service Programming Guide,
80-98482-1.

Globalstar UTPST Script API Reference Manual, 80-99114-1.

QUALCOMM Globalstar Data User Guide, 80-99126-1.

*QUALCOMM Globalstar GSP-1620 Satellite Data Modem
Integrator's Reference Manual*, 80-99208-1.

Cautions and Warnings



Warning

Before working with the modem hardware or power connections, remove rings, watches, and other metallic objects that could cause electrical shock or burns.



Caution

Use proper electrostatic discharge (ESD) equipment and procedures to avoid damage to the modem.



Caution

Any changes or modifications to this equipment not expressly approved in this document could void your warranty and your authority to operate this equipment.

1 Globalstar Overview

Globalstar is a voice and data telecommunications system utilizing a constellation of 48 low-Earth-orbit (LEO) satellites, providing nearly world-wide coverage (70° N to 70° S latitudes).

Globalstar Limited Partnership (GLP), the owner/operator of the LEO constellation, is a strategic partnership composed of many of the world's leading telecommunications providers:

- Alenia Marconi
- China Telecom
- DACOM
- Daimler-Chrysler Aerospace
- Elsacom
- Globalstar USA, Canada, and Mexico (formerly known as Vodaphone/Airtouch)
- Hyundai
- QUALCOMM Incorporated
- Space Systems/Loral
- TESAM (joint venture between France Telecom and ALCATEL)
- Vodaphone

The Globalstar system consists of a space segment, and a ground or earth segment.

Space Segment

The space segment consists of 48 LEO satellites (and eight additional in-orbit spares) built by Loral Space Systems and operated by Globalstar Limited Partnership (GLP) in San Jose, CA.

Compared to medium-Earth-orbit or geostationary-Earth-orbit (MEO/GEO) satellites, LEO satellites offer several advantages: minimal delay (~250 ms or comparable to terrestrial digital cellular), multi-satellite handoff, extremely small antenna, lower power consumption, and lower cost.

Ground Segment

The ground segment consists of Earth stations called Gateways, which provide service in specific geographical areas. The Gateways are deployed worldwide and communicate via C-band frequencies to/from the LEO satellites, which serve as “bent pipe” transponders.

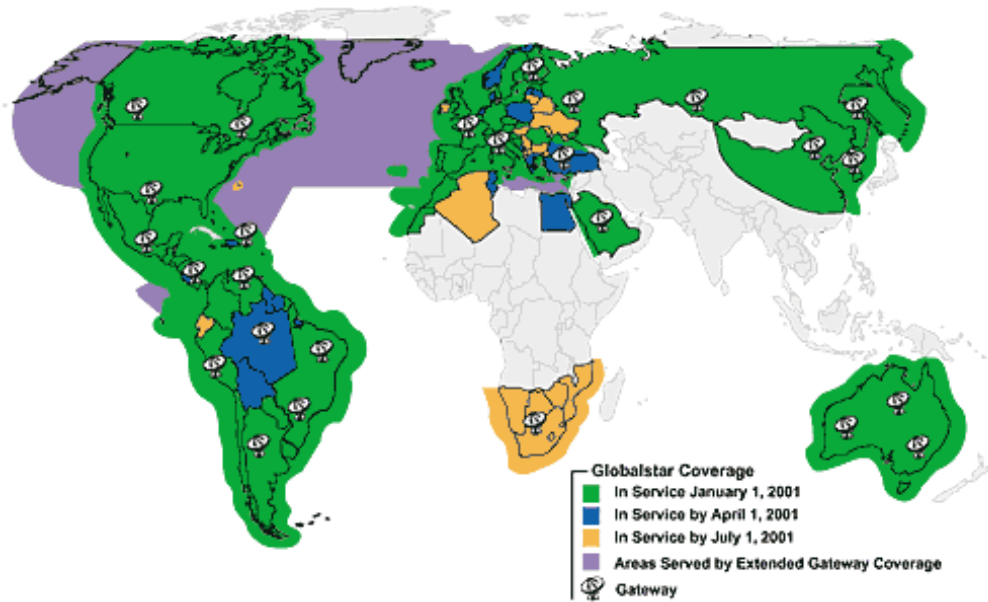
User Terminals communicate to/from a Gateway ground station using L- and S-band frequencies, via the LEO satellites.

A User Terminal can be either a QUALCOMM Globalstar GSP-1600 Tri-Mode Phone, or QUALCOMM Globalstar GSP-1620 Satellite Data Modem.

Coverage

Figure 1-1 shows Globalstar coverage areas and availability dates.

Figure 1-1 Globalstar Coverage Availability



The following list details Globalstar's expected service coverage as of January 1st:

Andorra	Chile	Italy	San Marino
Antigua & Barbuda	China	Liechtenstein	Saudi Arabia
Argentina	Colombia	Mexico	Slovakia
Australia	Croatia	Monaco	Slovenia
Austria	Czech Republic	Morocco	South Korea
Azores	El Salvador	Netherlands	Spain
Bahamas	Estonia	Antilles	Sweden
Belgium	Finland	Nicaragua	Switzerland
Bosnia-Herzegovina	France	Panama	United Kingdom
Brazil	French Guyana	Paraguay	United States
British Virgin Islands	Germany	Peru	Uruguay
Canada	Gibraltar	Portugal	Vatican City
	Guatemala	Puerto Rico	Venezuela
	Honduras	Romania	
	Iceland	Russia	

The map and list in Figure 1-1 depict current and planned Globalstar service coverage. Actual coverage may vary because of Gateway deployment, local licensing and other factors, including environmental conditions. “Service” means that a phone can be purchased and activated in that country.

You may be able to use a Globalstar phone in areas of extended Gateway coverage; however, neither Globalstar nor your Service Provider warrants that call duration or quality in these areas will meet normal system standards.

Globalstar roaming is not included. Please contact your Service Provider for information about roaming availability.

Carriers

Each coverage territory is typically aligned with country boundaries. A coverage territory has one or more Service Providers (SPs) or carriers that offer service to users, similar to a “cellular” model. Globalstar licenses the Service Provider or carrier to offer service in a part of the worldwide coverage area (one or more countries).

The Service Provider offers “airtime” to the OEM or end user. It also provides a customer care center and keeps billing records for the satellite airtime used and the data traffic sent and received.

Service Providers vary by region around the world. To identify the correct Service Provider in your area, refer to the Globalstar Web page: <http://www.globalstar.com>.

Distributors and OEMs for User Terminals

Customers access the Globalstar system by means of User Terminals, either QUALCOMM Globalstar GSP-1600 Tri-Mode Phones, or QUALCOMM Globalstar GSP-1620 Satellite Data Modems.

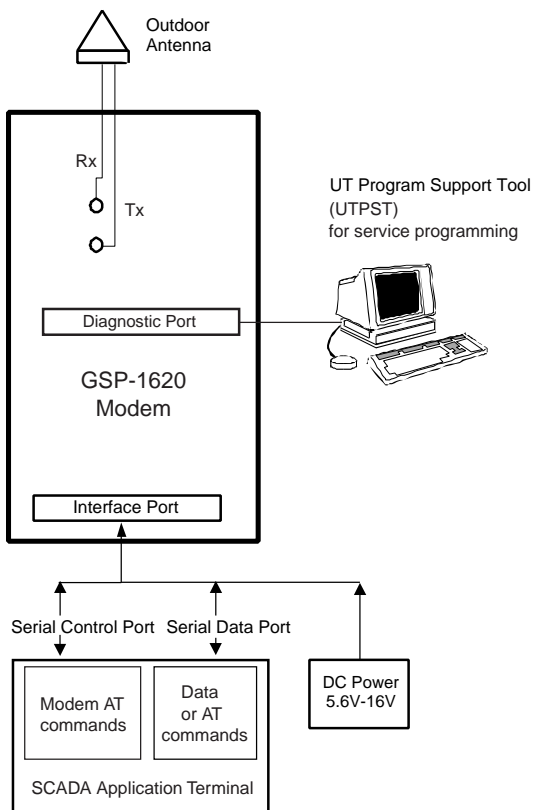
- For Tri-Mode Phones, cellular and satellite distributorships serve as retail sales conduits where customers can purchase, provision, and repair Tri-Mode Phones throughout the world.
- For the GSP-1620 Satellite Data Modem, OEMs directly integrate the modem into a market-specific product, which is then resold to a business/industrial customer.

2 GSP-1620 Modem Overview

The QUALCOMM Globalstar GSP-1620 Satellite Data Modem delivers reliable digital data communications wherever Globalstar data service is available, using QUALCOMM's patented CDMA technology and the Globalstar Communications System's constellation of 48 low-Earth-orbit (LEO) satellites.

Figure 2-1 depicts a conceptual overview of the Globalstar GSP-1620 Modem, including its ports and antenna.

Figure 2-1 Conceptual Diagram of GSP-1620 Modem



The GSP-1620 modem is a bare board “sandwich” stack of Circuit Card Assemblies (CCA) containing two boards:

- Globalstar RF board — includes the LNA, RF power amp, upconverters and downconverters, TCXO, synthesizers, and the remaining power electronics.
- Globalstar Digital board — includes the processor, the modem, and some of the power management electronics.

QUALCOMM offers the GSP-1620 modem without a mechanical enclosure, anticipating that OEMs will integrate and package the modem with the end-user’s application.

The GSP-1620 modem operates in the “Globalstar (or satellite) data mode only,” as opposed to the GSP-1600 Tri-Mode Phone, which has additional terrestrial cellular (analog and digital) and voice capabilities. The GSP-1620 modem is powered by an external power source provided by the user.

A weatherproof Dielectric Resonator Antenna (DRA), sometimes referred to as an Outdoor Unit (ODU), comes with each modem. OEMs provide antenna cables (SMA to MCX connectors), to meet customer antenna-cable length needs.

A single DB-25 (male) connector is used for the user interface port. The DB-25 carries DC power, as well as the Data and Control RS-232 signals, between the Supervisory Control and Data Acquisition (SCADA) application (the data terminating equipment or DTE) and the modem (the data communications equipment or DCE).

A Diagnostic port on the modem allows network provisioning (service programming) and software upgrades.

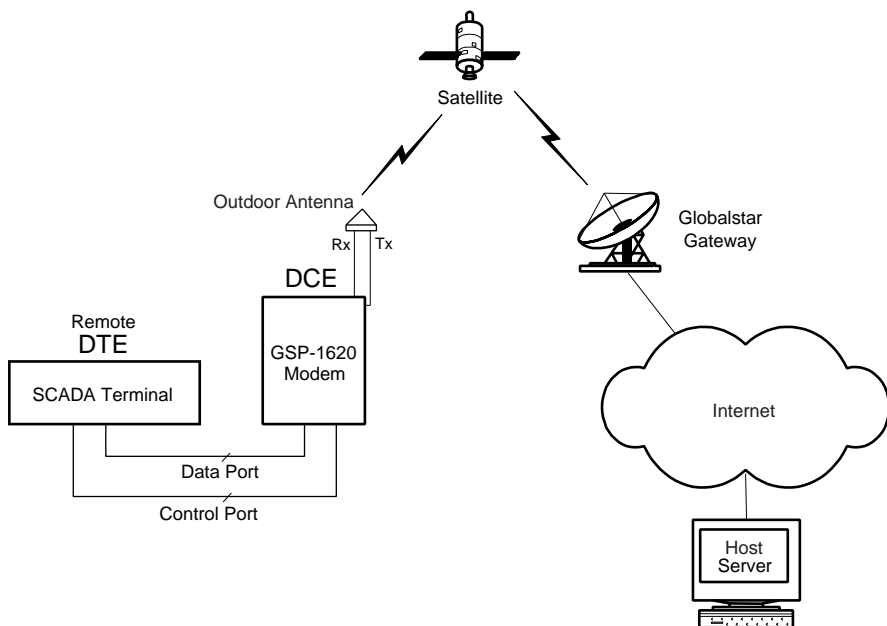
Packet and Asynchronous Data Service

The GSP-1620 modem handles two kinds of data connections:

- *Packet* — over the Internet or other TCP/IP packet-switched network
- *Asynchronous* — routed through the Public Switched Telephone Network (PSTN) to a destination modem

Figure 2-2 depicts a typical use of the GSP-1620 modem for a Supervisory Control and Data Acquisition (SCADA) application using packet data.

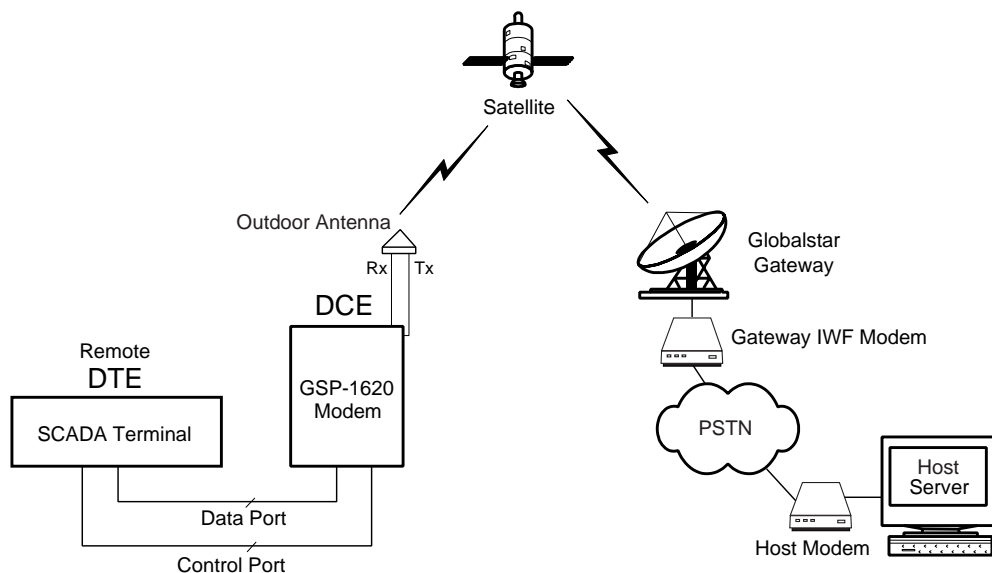
Figure 2-2 Typical Modem SCADA Application Using Packet Data



For packet data connections, the GSP-1620 modem essentially functions as a “node” on the Internet and, with its fixed or dynamically assigned IP address, can be addressed in real time as often as necessary to maintain application control over the remote devices.

Figure 2-3 depicts a typical use of the GSP-1620 modem for a SCADA application using asynchronous data.

Figure 2-3 Typical Modem SCADA Application Using Asynchronous Data



For asynchronous data connections, the GSP-1620 modem can dial or be dialed by a host modem, connecting through the Globalstar Satellite Communications System and the PSTN.

Modem Application Characteristics

For either packet or asynchronous connections, as shown in Figure 2-2 and Figure 2-3, modem applications have the following basic characteristics:

- The GSP-1620 modem serves as the DCE (data communications equipment) at the remote site. It functions essentially as a 9600 bps full duplex satellite modem. The modem uses typical Hayes AT commands (see Chapter 4, *AT Commands*). Standard RS-232

interfaces facilitate ease of use and OEM application integration.

- The SCADA application serves as the DTE (data terminating equipment, or terminal) at the remote site, communicating with software in the modem through AT commands sent to either the modem's Control or Data ports.
- Data flows to and from the modem over-the-air, using the Globalstar satellites and Gateways connected to the Internet (for packet data) or to the PSTN (for asynchronous data).
- OEMs provide the host application (server), which communicates with the remote SCADA application (DTE) to manage the field processing of data and reports process exceptions, performance reports, alarm conditions—in short, any data needed from the remote site.

**Note**

QUALCOMM offers a GSP-1620 Modem Integrator's Kit (MIK) to assist OEMs in developing user applications for GSP-1620 Satellite Data Modems, as described in Chapter 8, *Modem Integrator's Kit*.

Typical Modem SCADA Applications

In remote settings or difficult-to-access sites, acquiring and responding to process control and alarm data can be challenging and costly. For both system integrators and OEMs, the QUALCOMM Globalstar GSP-1620 Satellite Data Modem provides real-time, low cost, bi-directional data communication solution applications in remote locations for fixed or mobile use.

The GSP-1620 modem lets you retrieve data automatically from remote sites, such as power substations, telecommunication concentration nodes, oil and gas wells, pipes, and offshore facilities. Unmanned sensors connected to the GSP-1620 modem can monitor remote operations and initiate alert notifications.

Table 2-1 lists some typical Remote Monitoring and Supervisory Control and Data Acquisition (SCADA) applications.

Table 2-1. Typical GSP-1620 Modem Applications

Electric Utility Industry	Remote Security Systems Monitoring
Oil and Gas Wells, Tanks, Pipelines, Offshore Platforms	Energy Management
Water Treatment Plants	Retail Point of Sale (POS) Transactions
Remote Inventory Management	Remote Banking
Electronic Billboards	Agriculture
Highway Traffic Monitoring	Aircraft Weather/Messaging for Commercial and General Aviation

The GSP-1620 modem provides a cost-effective way to collect basic environmental and industrial data and turn remote locations into real-time business data centers.

Electric Utility Industry

In the electric utility industry, a SCADA application using the GSP-1620 modem could perform many tasks, for example:

- Remotely turn on a pump, close a switch, open a gate, or request a new meter reading.
- Capture polled, scheduled, and event-driven data cost-effectively.
- Monitor line voltage.
- Report on power outages, under/over voltage status.
- Monitor or remotely control the following:
 - ❑ Transfer switches.
 - ❑ Standby or portable generators.

- ❑ Remote substations.
- ❑ Capacitor bank monitors.
- ❑ Voltage regulators.
- ❑ Pole-top Remote Termination Unit (RTU).
- ❑ Load management.

Oil and Gas Wells, Tanks, Pipelines, Offshore Platforms

For oil and gas wells, tanks, pipelines, and offshore platforms, a SCADA application using the GSP-1620 modem could perform many tasks, for example:



- Monitor pipeline cathodic protection rectifiers to ensure operability.
- Remotely test the pipeline electrical discharges and receive alerts of electrical current buildup without an inspector driving from one 40-mile checkpoint to another, manually checking each location.
- Reduce costs, maximize use of personnel for repairs and maintenance, and receive real-time notification of a problem before a line ruptures.
- Monitor production well heads. Track mud flow in real-time to maximize profitability in the market.
- Monitor a remote “nodding donkey” rig to check energy and velocity amounts. Temporarily suspend, slow or stop the flow of oil when it drops below a profitable level, or shut down the rig if there are mechanical problems.
- Monitor pressure reduction equipment.
- Remotely control the converter volume and transmit data to a central system.
- Keep service interventions to a minimum.

Water Treatment Plants



For water treatment plants, a SCADA application using the GSP-1620 modem could perform many tasks, for example:

- Monitor water flow along pipelines and achieve better regulation of water pressure, thereby reducing unnecessary consumption and eliminating water loss.
- Reduce maintenance costs by detecting lift station failures.
- Monitor waterways and canals.
- Transmit the status of snowpack gauges, flow rates, and spillway conditions back to the control center to help regulate water flow in dam operations.
- Send back images taken by a remote camera of the river or spillway conditions to provide visual input along with the flow rate data.
- Set up automatic control systems on pumping stations, water towers, storage tanks and lift stations.
- Keep operations going smoothly in chemical tank monitoring. Don't pay for unnecessary inventory chemicals.
- Monitor tanks above and below ground for process variables such as pressure, temperature, and pH.

Remote Inventory Management

For managing remote inventory, a SCADA application using the GSP-1620 modem could perform many tasks, for example:

- Receive remote inventory information that can be reviewed in real time by procurement, logistics, production, transportation, sales and suppliers.
- Streamline inventory management with remotely monitored information delivered in real time.
- Eliminate stock-outs, shortages, and stockpiling.
- Provide faster response time so you can negotiate more effectively with customers and suppliers.

Remote Security System Monitoring

For remote security system monitoring, a SCADA application using the GSP-1620 modem could perform many tasks, for example:

- Transmit alarm messages wirelessly and securely.
- Remotely control video surveillance.

Energy Management

An energy management SCADA application using the GSP-1620 modem could perform many tasks, for example:

- Control energy usage in buildings, stores, and supermarkets by remotely tracking levels.
- Monitor temperatures, lighting, and motors.
- Monitor heating, ventilation and air conditioning (HVAC).
- Adjust levels as needed according to opening and closing times, realizing utility bill savings.

Remote Banking and Retail Transactions

For remote banking and retail transactions, a SCADA application using the GSP-1620 modem could perform many tasks, for example:

- Set up banking ATMs in remote areas with reliable and cost-effective Globalstar communications, without dependency on unreliable or expensive terrestrial communication lines.
- Transmit credit card verification and remote retail authorization transactions.
- Monitor performance and inventory of vending machines.
- Provide redundancy for wireline or cellular communication systems.

Agriculture

In agriculture, a SCADA application using the GSP-1620 modem could perform many tasks, for example:

- Monitor the harvest rate and determine if the yield is acceptable or if additional fertilizer, herbicides, and/or pesticides are needed.
- Relay the information to a host application that directs farm equipment to release the right amount of chemicals when processing crops in the field.

Aviation

In aviation, a SCADA application using the GSP-1620 modem could perform many tasks, for example:

- Transmit weather data to the cockpit.
- Transmit, receive, and amend flight plans in the air.
- Track aircraft position location and display it in a monitoring center.

3 Features

This chapter discusses key features of the GSP-1620 modem, including the following:

- General modem features
- Packet/asynchronous data overview
- Packet data service
- Asynchronous data service

General Modem Features

The general features discussed in this section work with either packet data or asynchronous data. For packet-specific features, see *Packet Data Service* on page 3-7. For asynchronous-specific features, see *Asynchronous Data Service* on page 3-11.

Globalstar Satellite Service

The QUALCOMM Globalstar GSP-1620 Satellite Data Modem offers full duplex (FDX) transmit and receive capabilities at 9600 bps via the Globalstar satellite constellation, and uses QUALCOMM's CDMA digital technology for reliability.

The Globalstar Air Interface (GAI) is based on a modified (proprietary) IS-95A standard adapted for Mobile Satellite System (MSS) operations:

- Forward Link (Modem Receive): 2484.39 to 2499.15 MHz
- Reverse Link (Modem Transmit): 1610.73 to 1625.49 MHz

AT Commands

The GSP-1620 modem can be controlled using standard AT (modem attention) commands, which are listed in Chapter 4.

Modes of Operation

The GSP-1620 modem has two serial ports: one for Data and one for Control. The modem can be set up to use the Data port only or both the Data and the Control ports.

- If solely the Data port is used, AT commands can be sent to the modem only when there is no data session active.
- If solely the Control port is used, only AT commands can be sent to the modem (no asynchronous or PPP data).
- If the both the Data and Control ports are used, the DTE can receive data on the Data port and, at the same time, communicate with the modem on the Control port using AT commands.

Using both the Data and Control ports allows more sophisticated communication with the modem and thus better control of it.

Short Messaging Service (SMS)

The GSP-1620 modem supports IS-637 Mobile Terminated Short Messaging Service (SMS). This is a separate feature from data (packet and/or asynchronous), and may be billed differently by the Service Provider.

Mobile-terminated SMS allows the host application to “send” numeric, alphanumeric, or binary messages to the GSP-1620 modem. These messages are passed transparently out the Data or Control RS-232 ports to the DTE (the SCADA application). The modem makes no attempt to construct ASCII character data. If “control” data is sent to the modem via the SMS option, it will be passed along transparently to the DTE (SCADA application).

The SMS feature is fully functional even if the GSP-1620 modem is active on a data call, because SMS can be accessed on the Control port. Therefore, the host application can send command and control information to the modem either while it is in a data session, or idle (not in a call).

**Note**

The SMS feature may not be available on all Gateways.

SMS Alerts

SMS “alerts” are asynchronous messages sent out of the Data or Control port to the DTE application upon receipt of the SMS message (see *Data and Control Ports* on page 5-4 for a more detailed explanation).

Port configuration determines how SMS alerts are received:

- If the application is using the Control port, SMS alerts are received on the Control port, even if a call is active.
- If the application is using the Data port only, the SMS alert will be queued until the data session is terminated.

Once the DTE application receives an SMS alert, it is up to the application to read the SMS message, using the `AT$QCSMS` command.

SMS Message Field Information

SMS messages can contain the following field information:

- Length of SMS
- Read status (new/read)
- Lock status
- Call back number (if available)
- Type (alpha, numeric, voice mail — these are carrier-specific fields)
- Priority (urgent, normal)
- Time received
- Message content

SMS AT Commands

The GSP-1620 modem can use the following SMS commands:

- Navigate through SMS messages (AT\$QCSMSM).
- Delete SMS messages (AT\$QCSMSM).
- Print/display current SMS message (AT\$QCSMSP).
- Lock or unlock SMS messages (AT\$QCSMSL).
- Turn on/off SMS alerting (AT\$QCSMSA).
- Get information on SMS messages stored in memory (AT\$QCSMSI).



Note

For more information, see Table 4-1 on page 4-1.

Globalstar Service Alerts

Service alerts are sent on the Control port or queued (if only the Data port is connected and in use) whenever a service parameter changes:

- Fades — Gateway/satellite coverage is lost for any reason.
- Acquisition — Gateway/satellite coverage is acquired (entering service, leaving service, or changing Service Providers).
- Roaming status — when the modem “roams” onto a Gateway outside the home service area (see your Service Provider for the scope of these areas).

Service Status Message

The `AT$QCSTATUS` command gets the Service Status Message, which you can think of as a message detailing the information that would display on the LCD screen of the GSP-1600 Tri-Mode Phone. The Service Status Message includes the following items:

- Service available (yes or no)
- Current service mode
- Current Service Provider name
- Gateway coverage “seen” (acquired) or lack of coverage (lost)
- Received signal strength (RSSI bars on the phone display)
- Gateway registration status (“i” indicator on the phone)
- Roaming (yes or no)
- Current call state (in call/idle)
- Call type
- Call duration

Position Location Determination

The GSP-1620 modem has a “get position” AT command, `AT$QCPLS`, that provides a latitude and longitude location as well as a confidence value.

This command has a parameter to select between getting the current position (via making a new request) or returning the last stored position:

- If you select the current position and you are NOT in a call, the modem returns “ERROR.”
- If you select the stored position and there is no stored position (you have never done a position request), the modem returns “ERROR.”

Packet/Asynchronous Data Overview

The GSP-1620 modem handles both *packet* and *asynchronous* data connections. For a particular SCADA application, one may make more sense than the other.

QUALCOMM Globalstar packet data service has a lower overhead and faster connection time than asynchronous data does. In general, if a SCADA application does not specifically need asynchronous data, it should use packet data instead.

Table 3-1 compares the two types of data.

Table 3-1. Packet vs. Asynchronous Data

Packet Data	Asynchronous Data
Connects through a Globalstar Gateway to the Internet.	Connects through a Globalstar Gateway and the PSTN to a remote host modem.
Packet data is transmitted over the Internet to a host server.	Asynchronous data is transmitted to a dial-up modem or modem bank, which must be supplied by the host.
Typically establishes connection within 2-3 seconds.	Typically establishes connection in approximately 30-60 seconds, due to modem negotiation and training time.
No long distance charges apply, because a connection is made directly to the Internet.	PSTN long distance charges may apply.
Degradation of service (in the transmission of packets) could occur, depending on Internet connections and routing.	Degradation of service could occur, depending on the quality of lines over the PSTN. (A noisy PSTN line can lower the data transmission rate or introduce errors into the data stream.)
May require a VPN and software to get past firewalls.	May be able to directly connect inside a firewall.
Mobile-terminated calls require either a fixed public IP address, or a fixed private IP address and VPN tunnel to the Gateway.	Mobile-terminated calls can be achieved by having the host modem dial the phone number of the GSP-1620 modem.

For more details about the two types of data service, see *Packet Data Service* on page 3-7 and *Asynchronous Data Service* on page 3-11.

Packet Data Service

Globalstar and the GSP-1620 modem offer direct Internet connectivity by bridging the “last thousand mile” air gap using LEO satellites. This section details the capabilities offered by the GSP-1620 modem for user connectivity and packet data transmission.

The GSP-1620 modem lets the application device (DTE) connected to the modem originate or receive a “packet data call” via standard AT commands (listed in Chapter 4, *AT Commands*). It establishes a PPP session, connects to the Internet, and then establishes a session with a host server.



Note

For a comparison of packet and asynchronous data, see Table 3-1 on page 3-6. For information about asynchronous data service, see *Asynchronous Data Service* on page 3-11.

Data Rate and Throughput

The GSP-1620 modem offers full duplex transmit and receive at a Data port rate of 9600 bps. Discounting packet data overhead bits, the measured effective “user” throughput (that is, customer data) averages 7400 bps for packet data.

Networking Software and PPP Sessions

The modem uses PPP as the transport mechanism for data packets. Standard networking software establishes, manages, and tears down the PPP session. For example, the networking software is compatible with Dial-Up Networking (TCP/IP and PPP protocols) on Windows 95/98/NT/2000.

When developing embedded SCADA applications, developers can use off-the-shelf protocol stacks or write their own. Any standard RFC 1661 or RFC 1662 compliant stack should work.

Interoperability with Different Operating Systems

The GSP-1620 modem uses standard networking software to establish, manage, and tear down the PPP session. The modem has been tested with the following standard operating systems:

- Windows 95/98/2000
- Windows NT
- Macintosh OS
- UNIX/Linux



Note

For Windows 2000, a possible software driver problem exists. For more information, contact QUALCOMM Globalstar Customer Service, as described in Chapter 10, *Product Support*.

IP Addressing for the GSP-1620 Modem

For packet data, the OEM or Service Provider must choose either a dynamic or fixed Internet Protocol (IP) addressing scheme, depending on the intended use of the GSP-1620 modem:

- If the modem is expected to be mobile and roam between Gateway service areas, a *dynamic IP addressing* scheme should be used. A new IP address may be assigned to the terminal equipment whenever a new packet data call is set up.
- If the unit is “fixed” in its position and no mobility is involved, either a *dynamic or fixed IP addressing* scheme can be used. However, if the unit is “fixed” in its position,

no mobility is involved, and the user's application requires a fixed IP address, then a *fixed IP addressing* scheme should be used.

The difference is that in a "fixed" addressing scheme the user's application at a host site or server will always know the IP address of the remote DTE (SCADA application). In a "dynamic" addressing scheme, the IP address is not known until the remote SCADA application/modem and the host/server are in an active session. In both the "fixed" and the "dynamic" addressing scheme, either the SCADA application/modem or the host/server can initiate a call/IP session.

Dynamic IP Addressing

A dynamic IP address pool in the Gateway can be configured with either private IP addresses or globally routable IP addresses. Therefore, the type of IP address assigned to a dynamic IP user during call setup depends on the Gateway configuration. With a dynamically assigned IP address, the modem can roam to another Gateway and re-establish Packet Data service by having the system automatically assign a new dynamic IP address.

With dynamic IP addressing, the modem can initiate a call/IP session with the host/server. Once a session is established, the assigned IP addresses remain constant until the session is terminated. With the added capability of dormant mode (see *Dormant Mode Service* on page 3-10), the IP address assigned during this session remains active even during temporary gaps in air link coverage or when a call is temporarily released via dormant mode.

Fixed IP Addressing

Fixed IP addresses can be assigned instead of dynamic IP addresses. With a fixed IP address, the server or host application can use a given specific IP address that is permanently assigned to the modem.



Note

In the first Gateway software release that supports modems, fixed IP addressing requires that private IP addresses be “decoded” from the modem’s IMSI (International Mobile Subscriber Identity). This precludes the use of fixed IP addressing with roaming between Gateways.

Virtual Private Network Service

Since a fixed IP addressing scheme requires the use of private IP addresses, a virtual private network or VPN (e.g., IPSec) or an IP-in-IP tunnel would have to be established between the host and the Globalstar Gateway, so the host can initiate IP sessions with the remote/SCADA unit.

When using dynamic IP addressing, an end-to-end VPN connection can be established between the remote/SCADA unit and the host/server.

Dormant Mode Service

With dormant mode service, the Globalstar system can keep the IP session “up” at the application layer (host and SCADA application) while dropping the air link/traffic channel, to conserve Globalstar resources and to decrease billing time to the user. The traffic channel is automatically reestablished upon receipt of PPP traffic at the SCADA application end or IP traffic at the Globalstar Gateway. The Globalstar system then completes the transmission, with no loss of user data.

Roaming and Packet Data Service

The GSP-1620 modem is capable of both “fixed” operation in one location (for example, a building, tank, pipeline, or well) or “mobile” operation for applications on trucks, rail cars, aircraft, or shipping containers.

For packet data service, roaming operation has the following characteristics:

- Roaming within a Gateway service area can keep the PPP session up the entire time, using dormant mode.
- Roaming between Gateway service areas is supported. However, there is no hard hand-off capability between separate Gateways. The PPP session will be dropped and will have to be reestablished by the modem.
- Once on a new Gateway, automatic re-registration will be performed and a new dynamic IP address will be assigned to the modem.
- Roaming support for “fixed” IP addressing outside the “home” Gateway service area is not currently supported. Future design work to allow a DNS server to map IP addresses to IMSIs is envisioned, which would permit worldwide fixed IP address roaming.

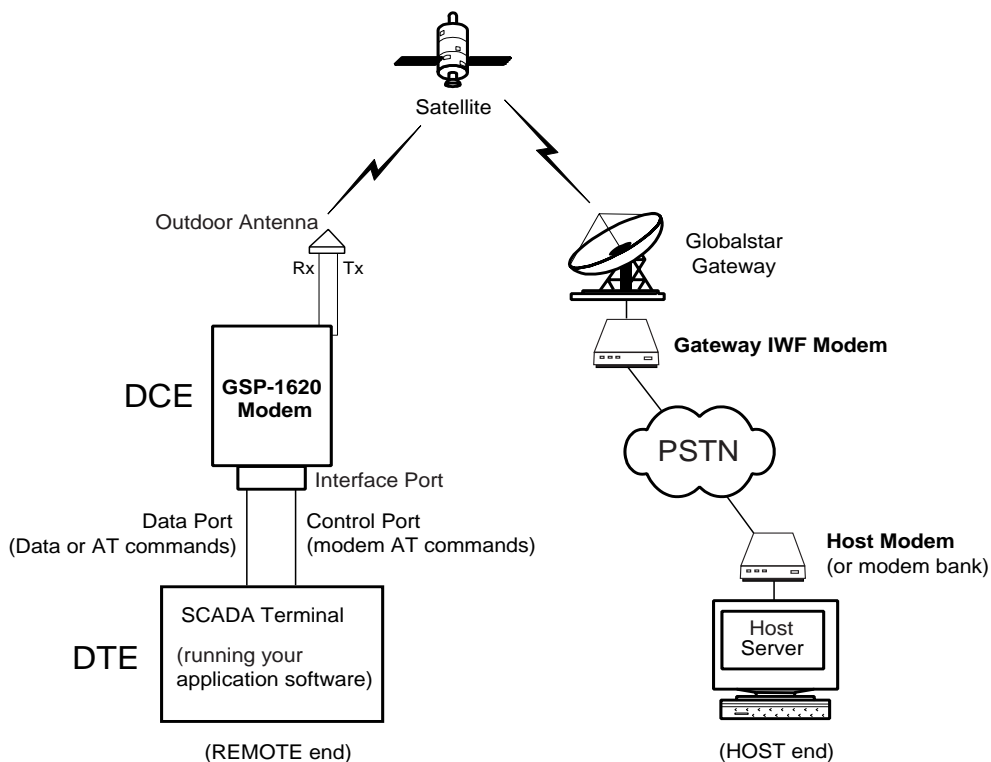
If service alerts are enabled, a service alert is sent out the Data/Control port whenever the Service Provider or Gateway changes. This includes the modem changing from roaming to home service area and vice versa.

Asynchronous Data Service

The GSP-1620 modem lets the application device (DTE) connected to the modem originate or receive an asynchronous data call. It can dial or be dialed by a modem at the host server, connecting through the Globalstar Satellite Communications System and the PSTN.

Figure 3-1 shows the various modems (the GSP-1620 DCE modem, the Gateway Interworking Function [IWF] modem, and the host modem) and other components involved in an asynchronous data call.

Figure 3-1 Asynchronous Data Call Components



Like most modems, the GSP-1620 modem allows customization of asynchronous data connections, data compression, and so on.

Data Rate and Throughput

For asynchronous data, the GSP-1620 modem offers full duplex transmit and receive at a Data port rate of somewhat less than packet data's 9600 bps, due to additional overhead for asynchronous data. Similarly, the measured effective "user" throughput (that is, customer data) is somewhat less than the 7400 bps (average) for packet data. Asynchronous connections take longer because of PSTN modem training time.

Accessing Packet Data Over an Asynchronous Connection

Once an asynchronous connection has been established for the GSP-1620 modem, it could be used to access packet data (using protocols such as PPP or SLIP).

If PPP is used on top of asynchronous data service, the DTE would be assigned an IP address. PPP would be required for Internet access using asynchronous data.

Protocols such as Z-modem or Y-modem or other proprietary protocols could be used to transfer data between the GSP-1620 modem and the host modem, without negotiating PPP.

Roaming and Asynchronous Data Service

The GSP-1620 modem is capable of both "fixed" operation in one location (for example, a building, tank, pipeline, or well) or "mobile" operation for applications on trucks, rail cars, aircraft, or shipping containers.

For asynchronous or "dialed" data service, roaming operation has the following characteristics:

- A host server can call the asynchronous Dial Number and reach the modem, regardless of which Gateway service area it is currently located in (just as voice GSP-1600 Tri-Mode Phones can roam and be reached in any Gateway service area).

- Roaming within a Gateway service area is supported for both mobile-originated and mobile-terminated asynchronous data calls.
- Roaming between Gateway service areas is supported; however, if the modem is in a call when it reaches the edge of a service area, the call will be dropped and must be re-established on the new Gateway.
- Once on a new Gateway, automatic re-registration will be performed and a new data call can be established.
- Fixed (or dynamic) IP addresses are not required for asynchronous data service as they are for packet data service.

If service alerts are enabled, a service alert is sent out the Data/Control port whenever the Service Provider or Gateway changes. This includes the modem changing from roaming to home service area and vice versa.

4 AT Commands

The AT (modem attention) command set is the control interface between the SCADA application (Data Terminal Equipment or DTE) and the GSP-1620 modem (Data Communications Equipment or DCE).

This chapter lists the AT commands that apply to the QUALCOMM Globalstar GSP-1620 Satellite Data Modem:

- Table 4-1, “Operational AT Commands” — lists the AT commands recognized by the modem software.
- Table 4-2, “Non-Operational AT Commands” — lists commands that are recognized, but not supported, by the modem. For example, because the modem has no speaker, the command to set speaker volume will neither set the volume nor return an `ERROR`. The command is accepted, but performs no action.

AT Command Quick Reference Tables

Table 4-1. Operational AT Commands

AT Command	AT Command Description (brief)
E	Set Command Echo OFF ON
I	Request Identification Information
Q	Result Code Suppression
V	DCE Response Format
X	Result Code Selection Command
Z	Reset Default Configuration
&C	DCE RLSD (DCD) Behavior
&D	DTE DTR Behavior
&F	Set to QUALCOMM-Defined Default Configuration

Table 4-1. Operational AT Commands (continued)

AT Command	AT Command Description (brief)
A	Answer Command
A/	Repeat Last Command
D	Dial: #777 for Packet Data call #627568 for Markov test call #56672225 for Loopback call <phone number> for Asynchronous Data call
H	Hook Control 0 to terminate the data call and return to Command mode (default) 777 to terminate the data call as above, but instruct the Gateway to transition into dormant mode
O	Return to Online State
S0	Auto Answer Ring Count (0 disables)
S3	Command Line Termination Character
S4	Response Format Character
S5	Command Edit Character
S6	Pause Before Blind Dialing Time
S7	Connection Completion Timeout
S8	Comma Dial Modifier Time
S9	Carrier Detect Threshold Timeout
S10	Carrier Loss to Disconnect Timeout
S11	DTMF Tone Duration and Spacing
S777	Silent Retry Timeout
+ICF	Character Framing Settings
+IFC	Local Flow Control Settings
+IPR	Rm Interface Baud Rate Setting
+CRM	Rm Interface Protocol Setting
~+++~	Direct the DCE to change from online to online-command mode (Note: the ~ character represents “guard-time” before and after the +++ escape sequence.)
+CTA	Dormant Mode Timeout Setting

Table 4-1. Operational AT Commands (continued)

AT Command	AT Command Description (brief)
+CFG	Set Remote Config String Command
+GSN	Read phone ESN
+DS	IWF (Interworking Function) Data Compression Control
+ES	IWF Error Control Selection
+MS	IWF Modulation Selection
\$QCMODE	Set Mode: Auto, Globalstar
\$QCSMSM	SMS list traversal and manipulation
\$QCSMSP	Print formatted information for current SMS message
\$QCSMSL	Lock current SMS message
\$QCSMSA	Set Alert on new SMS message arrival
\$QCSMSI	Send SMS message count information to DTE
\$QCERR	Send formatted Error Log information to DTE
\$QCCLR	Clear Error Log
\$QCSA	Set Alert on Service change (on/off)
\$QCSTATUS	Send formatted Service Status to DTE
\$QCTOD	Send formatted Time-of-Day to DTE
\$QCPLS	Send formatted Position information to DTE
\$QCMSTATS	Send formatted Markov statistics to DTE
\$+CMUX	Set Forward MUX Option
\$QCPKND	Set Packet Data Reconnect Methods
\$QCTCP	TCP Stack Changes
\$QCVJ	Use Van Jacobsen Header Compression

Table 4-2. Non-Operational AT Commands

AT Command	AT Command Description (brief)
L	Monitor Speaker Loudness
M	Monitor Speaker Mode
P	Select Pulse Dialing
T	Select Tone Dialing

5 Hardware Description

This chapter describes the QUALCOMM Globalstar GSP-1620 Satellite Data Modem hardware, including mechanical descriptions of the modem, antenna specifications, user interfaces, and grounding.

Modem Mechanical Description

The GSP-1620 modem is a sandwich made of two circuit card assemblies (CCAs) that are open and unprotected. As a result, the GSP-1620 modem must be shielded from direct impacts, precipitation, and particulates.

I/O is obtained through four connectors:

- Power, Data, and Control functions are accessed via a 25-pin “D” style connector.
- Globalstar RF transmit signals are routed to an MCX-style coaxial connector (labeled J3 on the board).
- Globalstar RF receive signals are routed to an MCX-style coaxial connector (labeled J7 on the board).
- The Diagnostic port interface is a 9-pin “D” style connector.

Modem Board Layout

This section includes the following technical drawings depicting the modem:

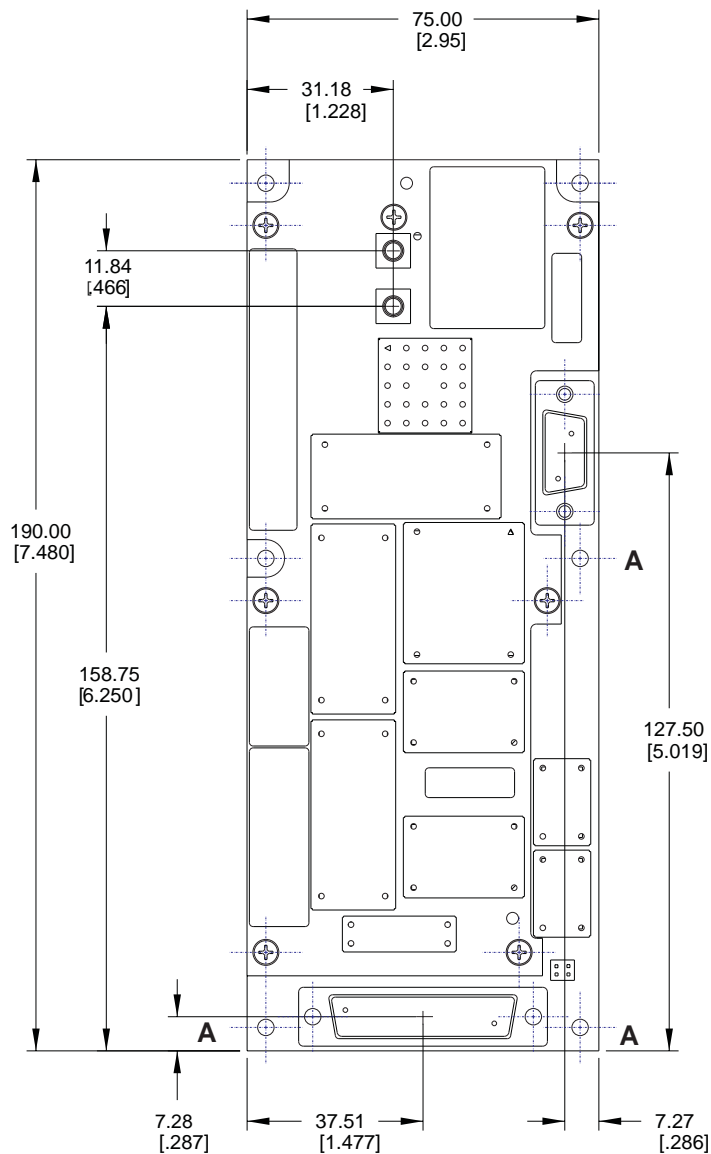
- GSP-1620 Modem Board Layout (Top View), Figure 5-1
- GSP-1620 Modem Board Layout (Side and Bottom View), Figure 5-2



Note

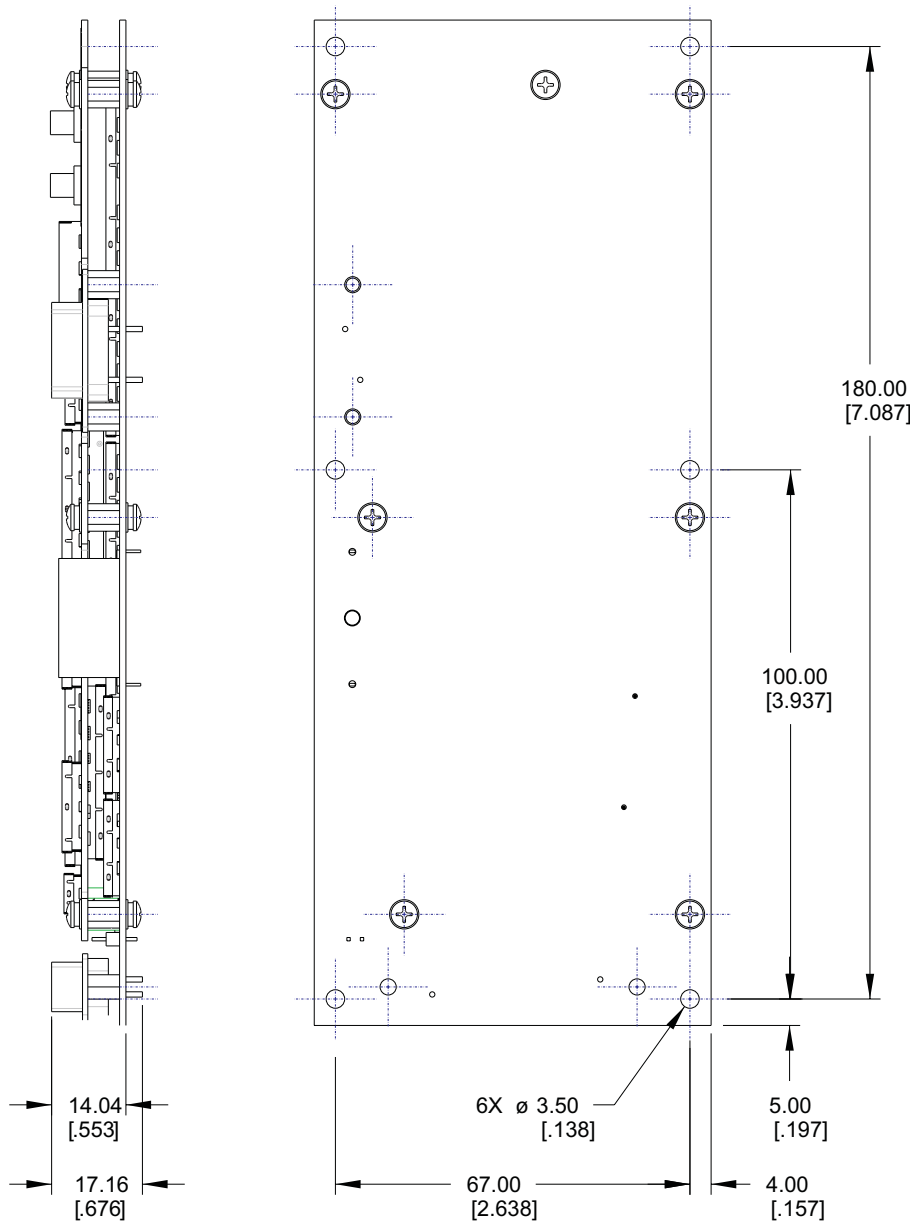
In Figure 5-1 and Figure 5-2, dimensions are shown as: millimeters [inches]. Millimeters are the controlling dimensions on these drawings. Inch dimensions are for reference only.

Figure 5-1 GSP-1620 Modem Board Layout (Top View)



Holes marked "A" connect to chassis ground.

Figure 5-2 GSP-1620 Modem Board Layout (Side/ Bottom Views)



Modem Dimensions and Weight

Modem dimensions are 190 x 75 x 17 millimeters (7.48 x 2.95 x 0.68 inches).

Modem weight is less than 180 grams (6.3 ounces).

Modem Antenna Connectors

The GSP-1620 modem has two (2) MCX snap-in connectors for the antenna leads, connecting the DRA to the modem:

- Transmit (Tx) lead is labeled **J3**.
- Receive (Rx) lead is labeled **J7**.



Caution

The MCX connectors are secured only by a solder joint and are not designed to withstand excessive force. When cables are connected to these connectors, care must be taken to ensure adequate strain relief is provided. Also, crossing the Tx and Rx cables between the antenna and modem can damage the modem.

Data and Control Ports

The Data and Control ports are combined into a single DB-25 male upright connector, which provides the primary user interface:

- The connector contains two (2) 9-pin serial ports, DC power leads, and a reset lead.
- Line speed for the Data port is variable between 300 bps and 115.2 kbps. (This is different from the over-the-air Data port rate, which is 9600 bps.)
- Line speed for the Control port is fixed at 9600 bps.
- Signaling uses 8 bits, no parity and 1 stop bit (8,N,1).
- All ports are ESD and short-circuit protected.

**Note**

The modem signal naming convention assumes that the modem is the DCE and that the user application is the DTE.

DTR/DSR Signal and Power On/Off

An active DTR on any of the three serial ports (Data, Control or Diagnostic) turns on the GSP-1620 modem (if DC power is applied first). The modem then boots up from the shut-down state and asserts DSR to indicate that it is booted up and ready to communicate.

The modem starts its power-down sequence only after the DTR lines on all three serial ports connected to the modem are de-asserted for a minimum of one second. Just before the modem powers off, it de-asserts DSR to let the application know that it is okay to remove DC power to the modem without risk of losing volatile data.

This mode of operation is useful in cases where power to the modem as well as the rest of the system might be turned off periodically to conserve battery power.

In case the modem “hangs up” and the watchdog circuit does not reset the modem, the user can reset the modem by pulling the `MODULE_RESET_N` low for a period of 5 seconds or more and releasing it to allow it to float. Pulling the line low has the effect of a power-on reset and not just a watchdog reset.

Control Port Signals

The Control port (CP) is an RS-232-level asynchronous interface operating at 9600 bps using Transmit Data (TxD), Receive Data (RxD), Data Terminal Ready (DTR), Data Set Ready (DSR), and Signal Common (GND).

RxD and TxD perform data transfer and handshaking, while DTR is used to turn on the modem and to let it know that there is an application waiting to talk to it.

The Control port specifically allows dedicated usage of the Data port by the application. It allows all AT commands,

modem alerting, and SMS messages to be sent simultaneously via a separate “control” port to/from the modem. This separation of functionality is especially useful in dormant mode, when the application and host sessions are active, and thus the Data port appears active/in use, although a Globalstar traffic channel is not up (no “In Call Status Message”).

The Control port is “enabled” by asserting DTR on the Control port.

In case of a reboot (due to fatal errors or any other reason), the DSR line will be set inactive so that the user application can detect a reset condition and take the necessary action.

Data Port Signals

The Data port (DP) is a hardware-flow-controlled, RS-232 level, asynchronous serial interface:

- The Data port uses the following RS-232 leads for operations: Transmit Data (TxD), Receive Data (RxD), Clear To Send (CTS), Data Terminal Ready (DTR), Data Set Ready (DSR), Ready to Send (RTS), Data Carrier Detect (DCD), Ring Indicator (RI), and Signal Common (GND).
- The format for data on the Data port is 8 bits, no parity and 1 stop bit.
- The baud rate is user-configurable to selected rates from 300 bps to 115.2 kbps. The baud rate is adjustable in software.
- In case of a reboot (due to fatal errors or any other reason), the DCD and DSR lines will be set inactive so that the user application can detect a reset condition and take the necessary action.
- Functionally, the Data port integrates AT commands and alert messages as well as application data traffic.

DB-25 Data and Control Port Pinouts

Table 5-1 provides detailed information about the Interface connector pinouts.

Table 5-1. Interface Connector Pinouts

Pin number	Signal Name	Signal level	Direction User <-> Modem	Description
1	Chassis Ground	-	Chassis Ground	Isolated chassis ground
2	DP_TXD	RS-232	DTE -> DCE	Data port TXD
3	DP_RXD	RS-232	DTE <- DCE	Data port RXD
4	DP_RTS	RS-232	DTE -> DCE	Data port RTS
5	DP_CTS	RS-232	DTE <- DCE	Data port CTS
6	DP_DSR	RS-232	DTE <- DCE	This pin is the DSR for the Data port and is asserted when the modem detects activity on the Data port and is ready to communicate with the DTE over this port. This signal is de-asserted when the modem detects no activity on the Data port; or is de-asserted as an acknowledgment to the user, indicating that the modem has completed its power-down sequence after the DTR lines of all serial ports have de-asserted.
7	Ground	Ground	Ground return	Ground return
8	DP_DCD	RS-232	DTE <- DCE	Data port DCD
9	DC_POWER	5.6V-16V		Modem power
10	DC_POWER	5.6V-16V		Modem power
11	Ground	Ground	Ground return	Ground return

Table 5-1. Interface Connector Pinouts (continued)

Pin number	Signal Name	Signal level	Direction User <-> Modem	Description
12	CP_DTR	RS-232	DTE -> DCE	Control port DTR
13	Reserved	Reserved	Reserved	
14	CP_TXD	RS-232	DTE -> DCE	Control port TXD
15	CP_DSR	RS-232	DTE <- DCE	This pin is the DSR for the Control port and is asserted when the modem detects activity on the Control port and is ready to communicate with the DTE over this port. This signal is de-asserted when the modem detects no activity on the Control port; or is de-asserted as an acknowledgment to the user, indicating that the modem has completed its power-down sequence as no active DTR lines were seen on the serial ports.
16	CP_RXD	RS-232	DTE <- DCE	Control port RXD
17	MIC_P	Analog	Input to modem	Analog Microphone Input (Reserved for Future Use)
18	MIC_N	Analog	Input to modem	Analog Microphone Input (Reserved for Future Use)
19	Reserved	Reserved	Reserved	
20	DP_DTR	RS-232	DTE -> DCE	Data port DTR
21	Ground	Ground	Ground return	Ground return
22	DP_RI	RS-232	DTE <- DCE	Data Port RI

Table 5-1. Interface Connector Pinouts (continued)

Pin number	Signal Name	Signal level	Direction User <-> Modem	Description
23	SPKR_P	Analog	Output from Modem	Analog speaker output (Reserved for Future Use)
24	SPKR_N	Analog	Output from Modem	Analog speaker output (Reserved for Future Use)
25	MODULE_RESET_N	TTL	Input to Modem	Hard reset of the modem, inverted logic. This line should be left floating for normal modem operation. In case the application detects that the modem is not responding, it can initiate a hard reset of the modem by pulling this line low (below 0.3V) for more than 5 seconds. The modem will reboot after the line is allowed to float.

Diagnostic Port

The Diagnostic port consists of a single DE-9 male upright connector, located on the right side of the GSP-1620 modem (see Figure 5-1).

The Diagnostic port allows a modem to be service-programmed or modem software to be upgraded, using the Globalstar User Terminal Program Support Tool (UTPST).

The Diagnostic port has the following characteristics:

- Uses TTL levels, un-translated
- TxD, RxD, RTS and CTS for hardware flow control
- DTR to turn on the modem from the UTPST

- POWER for an active translator Diagnostic cable
- PROGRAM to enable programming of the modem



Note

Normal field usage does not require that a cable be connected to the Diagnostic port on the modem, since that port is typically used for development and programming only.

DC Power

The GSP-1620 modem requires input DC power ranging from 5.6 V to 16 V, with 1 Amp (maximum). The modem DC input power must be clean (maximum of 50 mV peak-peak ripple and noise) and must be within the absolute maximum voltage range of 5.6 V to 16 V under all conditions. For typical DC power consumption limits, see *Power Consumption* on page 5-12.

The GSP-1620 modem uses a DC/DC converter to source its internal operating voltages and behaves like a constant power load over varying input voltages that has a varying input impedance when the modem is transmitting data. This creates a potential for oscillations on the DC power line if the input impedance of the modem is lower than that of the power supply sourcing the power.

The approximate minimum input impedance of the modem is given by $R = V^2/P_{\max}$ where V is the operating voltage of the modem and P_{\max} is the maximum power consumed by the modem. For example, the minimum input impedance of the modem at 12V would be approximately $12^2/5.4 = 26.7$ Ohms. Any DC power supply capable of supplying the peak demand of 5.4W at 12V would have this output impedance. Additional design margin of at least 20% is recommended beyond this minimum value.

Care should be taken that if additional EMI filtering is added (see *EMI Filtering* on page 5-11), the impedance as seen by the modem's input power supply does not exceed this value.



Caution

OEMs must ensure that the output impedance of the power supply sourcing DC power to the modem is always less than that of the input impedance of the modem. Otherwise, a potential exists for oscillations on the DC power line and the GSP-1620 modem will not operate as designed.

Surge Protection

OEMs are responsible for ensuring that the input voltage specification will never be exceeded.

Minimal transient protection is provided on the GSP-1620 modem board but this is intended only for low energy/duration events (total transient power less than 1 kW). It is not intended to protect the modem in case of a sustained over-voltage/lightning condition.

The use of a fuse is strongly recommended in the power supply connecting to the GSP-1620 modem. The input surge current requirements of the GSP-1620 modem are such that a fuse with a minimum melting I^2t rating of 0.02 A^2 seconds will be sufficient.

EMI Filtering

Adequate conducted EMI filtering has already been provided in the GSP-1620 modem to pass FCC and ETSI limits. Additional filtering should not be necessary to meet these requirements.



Caution

Should additional filtering be necessary, OEMs must take precautions to ensure that the above criteria are not violated. Please contact QUALCOMM Incorporated for further details in such a case.

Power Consumption

Power consumption depends on a variety of factors such as transmit power, input voltage, and data rate. Table 5-2 summarizes the power consumption of the GSP-1620 modem at an input voltage of +12 V DC. All power estimates include the DC power consumption of the ODU's receive section.

Table 5-2. Modem DC Power Consumption Estimates at 12 V DC Input

Mode	Minimum	Typical	Maximum
Shutdown	1.2 mW	2.4 mW	6 mW
Standby	280 mW	500 mW	2.4 W
Transmit	3.6 W	4.8 W	5.4 W

The power modes in Table 5-2 are as follows:

- **Shutdown** — The modem is not operational in this state and reverts to this state when DTR lines are inactive.
- **Standby** — The receiver section in the modem is active during this time and the modem is ready to transmit/receive data.
- **Transmit** — The modem's transmitter is active in this state and may be in the process of transmitting/receiving data.

Power-On

Power-on is controlled via OR'd DTR signals from any port (Data, Control or Diagnostic). When DTR is asserted on one or more of the ports, the GSP-1620 modem powers up. Upon successful power-up, the modem asserts the DSR line of each active port to let the user know that it has booted up successfully and is ready to accept commands. Only the Data and Control ports include DSR lines.

**Note**

At least one port DTR signal must remain asserted during the entire power-on sequence, until a DSR signal is asserted.

Power-Off

Power-off is also controlled via the OR'd DTR signals. When all port DTRs have been de-asserted for a minimum of one second, the GSP-1620 modem begins its power-down sequence. After all software processing has concluded, the modem powers off. This causes loss of power to the Data and Control port RS-232 transmitters, de-asserting the ports' DSR lines and informing the user it is safe to remove power.

**Caution**

Removing power before the DSR signals are de-asserted can corrupt the modem's service programming parameters and other data stored in non-volatile memory.

**Note**

All port DTR signals must remain de-asserted during the entire power-down sequence, until the DSR signals are de-asserted.

**Note**

DSR/DCD will also go inactive in case of a fatal error that causes the modem to reboot.

Hard Power Reset

Provisions equivalent to power cycling (see Pin 25 in Table 5-1) are included to "hard reset" a GSP-1620 modem under user control. This pin is pulled low for a minimum of five seconds to reset the modem. The line is normally left floating.

Grounding

The GSP-1620 modem has been designed to provide flexibility in the area of grounding, with options to make connections between digital ground and the OEM-provided chassis ground (metallic enclosures). These grounding options are also independently available for the DB-25 user interface, Diagnostic port, and associated cable shields.

The GSP-1620 modem has been certified in accordance with the technical and regulatory requirements of the FCC and the European Union. The modem was tested in a configuration that did not include, or require, an enclosure or specially shielded cable configuration in order to demonstrate compliance with the requirements.

OEM applications may need different grounding configurations. The options are as follows:

- **Option 1** — A chassis ground connection to the modem may be established using conductive support posts/screws between the modem mounting holes, where the solder mask is exposed on both sides of the board, and the OEM-provided chassis (metallic enclosure or base).
- **Option 2** — DNI (do not install) resistors (R216 and R217) on the modem circuit card allow for the option of connecting digital ground and chassis ground together.
- **Option 3** — The user interface DB-25 cable shield termination is provided through Pin 1 of the DB-25 connector. The cable shield drain wire may be connected to this pin to provide a termination of the cable shield to either chassis or digital ground (options 1 & 2 dependency).



Caution

The RF connector ground is the same as the signal and power ground. OEMs should understand this when designing an integrated product for use in environments where surge protection may be required. They should also be aware of this fact to avoid ground loops in the final installation.

OEM Installation of the GSP-1620 Modem

QUALCOMM offers the GSP-1620 modem without a mechanical enclosure, anticipating that OEMs will integrate and package the modem into an enclosure or cabinet appropriate to the end-user's application. The enclosure must shield the GSP-1620 modem from direct impacts, precipitation, vibration, acoustic noise, and particulates.

The GSP-1620 modem has six mounting holes sized for M3 screws. All six mounting locations of the modem must be fastened to a rigid structure to meet the vibration and shock requirements specified in Chapter 6, *Environmental Specifications*.

For hole size and locations, connector locations, and overall envelope dimensions, see Figure 5-1 on page 5-2 and Figure 5-2 on page 5-3.



Caution

When mounting the GSP-1620 modem into an enclosure or onto a surface, OEMs must exercise care during the process. Adhere to the following recommendations:

- Observe handling precautions necessary to avoid damage by ESD.
- Fasten the modem to a planar surface of sufficient flatness and rigidity to prevent flexing of the modem.
- Use shock mounts when the environment includes vibration in excess of that shown in Figure 6-2 on page 6-4.
- Use acoustic dampening material when the environment includes acoustic noise in excess of 110 dB OSPL (Overall Sound Pressure Level).
- Do not use fasteners that will damage the grounding areas around the through holes.
- Do not fasten the modem using tools with speed and/or torque that will cause damage to the printed circuit board.

- Do not fasten the modem with enough clamping force to damage the printed circuit board.
- Exercise caution and do not damage components on the modem during handling.



Note

The GSP-1620 modem meets or exceeds all operational vibration requirements defined in Table 6-1 on page 6-4 when E-A-R damping feet (MF-100-UC04-H, black) are used as shock mounts.

Modem Antenna Specifications

The GSP-1620 modem is to be used with an aluminum Dielectric Resonator Antenna (DRA), as shown in Figure 5-3 and Figure 5-4. The modem DRA has a passive transmit and an active receive section. The transmit (Tx) and receive (Rx) connectors are labeled on the antenna.

Figure 5-3 DRA Side View

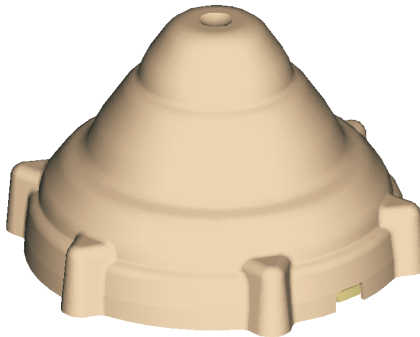
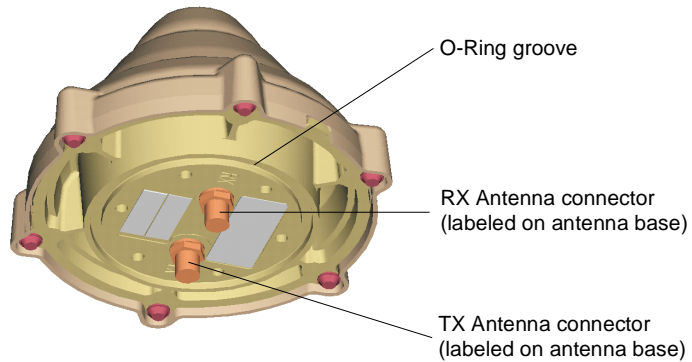


Figure 5-4 DRA View Showing Connectors



Antenna Dimensions and Weight

The DRA is 103 millimeters diameter by 63 millimeters tall (4.1 inches diameter by 2.5 inches tall).

The weight for the antenna is less than 250 grams (8.8 ounces).

Antenna Depiction

This section includes the following technical drawings that depict the antenna:

- GSP-1620 Antenna: DRA Top and Side Views, Figure 5-5
- GSP-1620 Antenna: DRA Bottom View, Figure 5-6



Note

In Figure 5-5 and Figure 5-6, dimensions are shown as: millimeters [inches]. Millimeters are the controlling dimensions on these drawings. Inch dimensions are for reference only.

Figure 5-5 DRA Top and Side Views

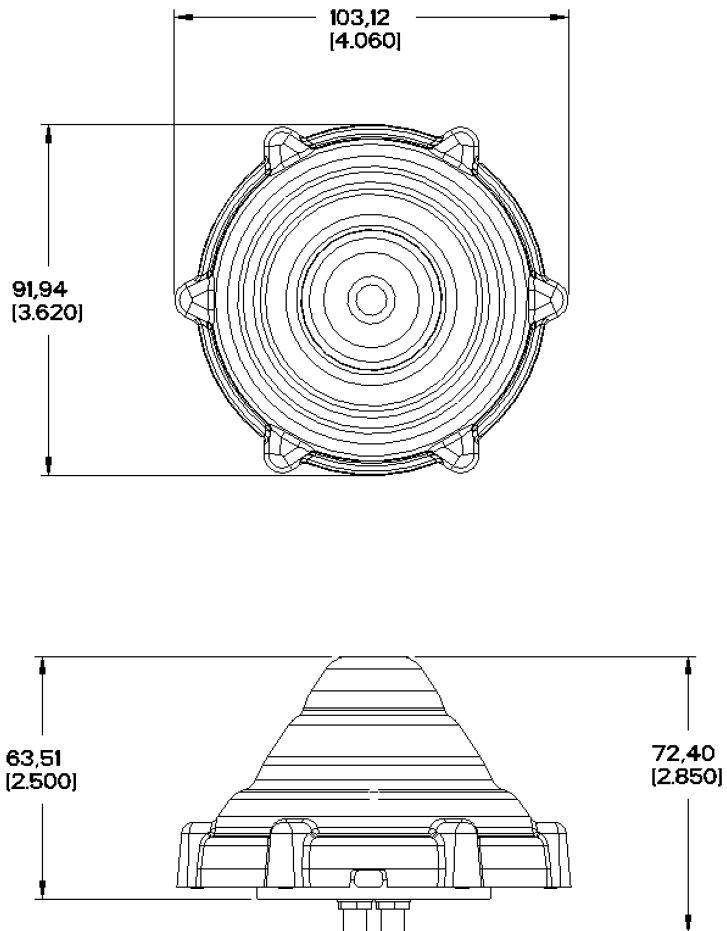
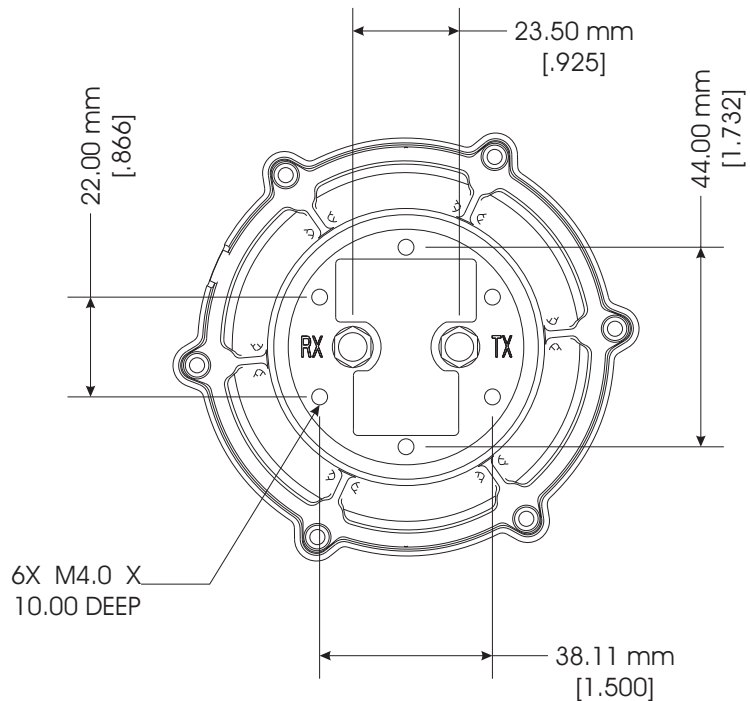


Figure 5-6 DRA Bottom View and Mounting Hole Locations



Antenna Cable Specifications

The DRA requires two (2) cables, one for transmit and one for receive:

- The required connectors are plug SMA (DRA bulkhead) to plug MCX (modem).
- Transmit cable maximum 0.6 dB insertion loss @ 1618 MHz is required for the cable.
- Receive cable maximum 3.0 dB insertion loss @ 2492 MHz is required for the cable.

QUALCOMM does not provide cables for OEM bulk applications since OEMs may need cables of different lengths for particular applications. Table 5-3 lists potential suppliers of RF and microwave connectors and cable assemblies.

Table 5-3. Suggested RF Cable and Connector Suppliers

Voilex Inc.:	
<i>Company:</i> Voilex Inc. 1 Batterymarch Park, Quincy, MA 02169 USA Tel: +1 617 376-0555 Fax: +1 617 376-0590 Email: jim_stout@voilexna.com Web: http://www.voilex.com/	
Times Microwave:	
<i>Company:</i> Times Microwave Systems 358 Hall Avenue P.O. Box 5039 Wallingford, CT 06492-5039 Tel:1(800)TMS-COAX (867-2629) Tel: +1 203 949-8400 Fax: +1 203 949-8423	<i>Sales Representative:</i> Dave Murray 505 W. Ray Road Suite #3 Chandler, AZ 85225-7283 Phone: +1 480 786-1656 Fax: +1 480 786-3684 Page: +1 800 618-6140 email: timeswest@aol.com
JPM:	
<i>Company:</i> JPM Corporate 155 North 15th Street Lewisburg, PA 17837 USA Tel: +1 570 524-8225 Fax: +1 570 524-5660 Web: http://www.jpenco.com/	

Calculating Antenna Cable Length

The maximum loss for an antenna cable of any length is 0.6 dB at 1.6 GHz for modem transmit and 3 dB at 2.5 GHz for modem receive.

OEMs must take these losses into account when calculating antenna lengths for a GSP-1620 modem installation. For example, the GSP-1620 Modem Integrator's Kit utilizes three feet of LMR 195 cable, which has a loss of 0.6 dB at 1.6 GHz.

Mounting Antennas at the Field Site

When mounting an antenna on-site, OEMs must position it properly to obtain Globalstar satellite signals. An antenna can be mounted on a flat surface or on a pole. In either case, the antenna connectors should be sealed against dirt and moisture.



Caution

The ODU must be installed in a configuration that ensures a minimum line-of-sight separation distance of 21.5 centimeters (8.5 inches) is maintained at all times between the ODU and any personnel.

Mounting and Sealing Antennas on Flat Surfaces

OEMs can mount the modem antenna (DRA) on a flat surface with six M4 screws. Depending on whether the surface is smooth or rough, different methods are recommended for sealing out moisture and dirt from the antenna's SMA connectors, which are not sealing connectors.

If the surface is smooth, flat, and solid, an O-ring can protect the antenna's connectors. The O-ring should be 2.050 inches in diameter by 0.103 inch wide, to fit within the groove on the bottom of the antenna. Silicone or ethylene-propylene is the preferred material.

A recommended source is:

Parker Seal Group
18321 Jamboree Rd.
Irvine, CA 92612-1073
Tel: 800/272-7537
Fax: 949/851-2127
Parker part number: 2-137 E515-80
Description: O-ring, ethylene-propylene, 2.050 inches
diameter by 0.103 inch thick, 80 durometer

When mounting the antenna on rough surfaces, surfaces which have already suffered significant environmental damage (pitting, peeling paint, etc.), or surfaces that are not sufficiently flat, it is recommended that an O-ring not be used. O-rings need smooth, flat surfaces to work.

Instead, the groove on the antenna, which is normally used for the O-ring, can be filled with an adhesive caulking material that can bond to the aluminum antenna base and the surface to which the antenna is being mounted. The caulk seals out moisture and dirt.

Mounting and Sealing Antennas on Poles

Instead of mounting the modem antenna (DRA) on a flat surface or bulkhead, OEMs can mount it on a pole with six M4 screws. A pole mount may be desirable in snowy locations, to prevent wet ice or snow from building up to more than the maximum allowable thickness of 20 centimeters (8 inches).

In a pole mounting, the antenna's SMA connectors, which are not self-sealing, are exposed to weather and precipitation. Therefore, the SMA connectors should be sealed with a commercially available coating for outdoor cable or electrical connectors.

Mounting Multiple Antennas

If required for the application, OEMs can mount multiple antennas within several feet of each other without creating significant interference.

QUALCOMM testing has determined that if two antennas are placed near each other and transmit on different frequencies, only a barely perceptible (1 dB or less) increase in 1605 emission occurs when tested at full jamming power. This maps to isolation between antennas of 20 dB. Even for antennas whose bases were touching (zero inches separation) the isolation was 22 dB in the worst case of rotation with respect to one another.

6 *Environmental Specifications*

This chapter describes environmental specifications for both the QUALCOMM Globalstar GSP-1620 Satellite Data Modem and its Dielectric Resonator Antenna (DRA).

The environmental requirements specified herein are under development and are subject to change without notice.

GSP-1620 Modem Environments

Environments affecting the GSP-1620 modem include temperature/humidity, thermal radiation, altitude, vibration, mechanical shock, and acoustic noise. This section also discusses connector durability, materials, and shipping.

Temperature/Humidity

Operational

The GSP-1620 modem operates as specified during exposure to the operational temperature/humidity envelope shown in Figure 6-1.



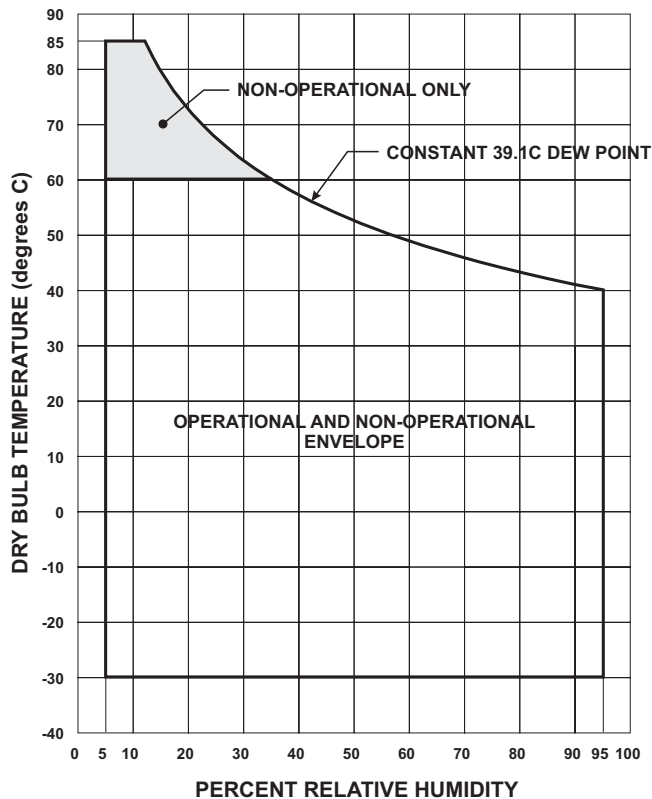
Caution

Condensation on the GSP-1620 modem is *not* permissible.

Non-Operational

The GSP-1620 modem operates as specified after exposure to the operational and non-operational temperature/humidity envelopes shown in Figure 6-1.

Figure 6-1 GSP-1620 Modem Temperature/Humidity Envelope



Thermal Radiation

The temperature profile shown in Figure 6-1 includes temperature rise due to thermal radiation, solar radiation, and other heat loads. The GSP-1620 modem dissipates heat that is dependent on the mode and the transmit power. The dissipated heat is the difference between the DC input power and the RF transmitted power.

Altitude

Operational

The GSP-1620 modem operates at standard atmospheric pressure altitudes between 0 and 15,000 meters (50,000 feet).

Non-operational

The GSP-1620 modem operates as specified after storage at pressure altitudes ranging from 0 to 15,000 meters (50,000 feet).

Vibration

Operational - Random

The GSP-1620 modem operates as specified during exposure to the random vibration spectrum defined in Figure 6-2.

Non-Operational - Random

The GSP-1620 modem operates as specified after exposure to the random vibration spectrum defined in Figure 6-2.

Operational - Sinusoidal

The GSP-1620 modem operates as specified after exposure to the swept sinusoidal vibration environment defined in Table 6-1 when E-A-R damping feet (MF-100-UC04-H, black) are used as shock mounts.

Non-Operational - Sinusoidal

The GSP-1620 modem operates as specified after exposure to the swept sinusoidal vibration environment defined in Table 6-1.

Figure 6-2 GSP-1620 Modem Random Vibration Spectra

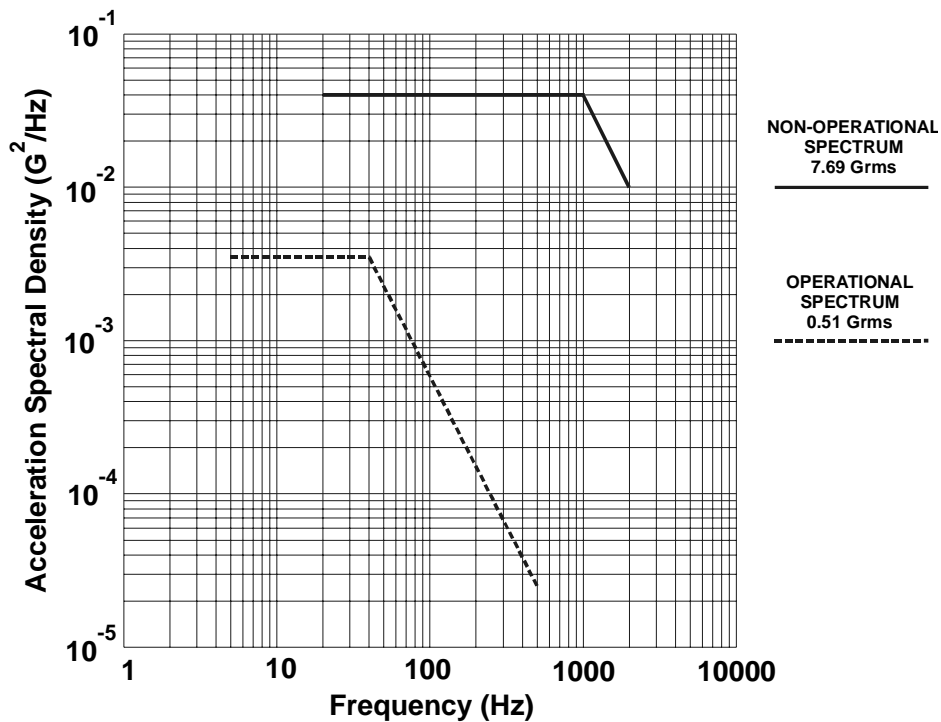


Table 6-1. Swept Sine Vibration Definition

	Double Amplitude Displacement (inch)	Acceleration (Gs)	Frequency Range (Hz)
Operational	0.28		2 to 6
		0.5	6 to 500*
Non-Operational	0.59		2 to 8
		2.04	8 to 200
		4.08	200 to 500

* E-A-R damping feet (MF-100-UC04-H, black) used as shock mounts

Mechanical Shock

Operational

The GSP-1620 modem operates as specified while being subjected to a half sine pulsed acceleration wave form of 11 milliseconds in duration, 2 Gs peak.

Non-Operational

The GSP-1620 modem operates as specified after being subjected to a half sine pulsed acceleration wave form of 6 milliseconds in duration, 30 Gs peak.

Acoustic Noise

The GSP-1620 modem is sensitive to very high ambient noise levels. Exceeding specified levels will cause degraded performance. Steps must be taken to ensure that the noise level at the module does not exceed 110 dB OSPL (Overall Sound Pressure Level).

Digital Data Connector Durability

Applied Forces

The digital data connector meets all performance requirements after application of a 24.5 newton force on the mating connector, applied in six directions—two opposite directions along each of three mutually perpendicular axes.

Mating cycles

The digital data connector meets all performance requirements after a minimum of 3,000 connect/disconnect cycles.

RF Connector Durability

The GSP-1620 modem RF connectors meet all performance requirements after 500 connect/disconnect cycles at a maximum rate of 12 cycles per minute.

Materials

The GSP-1620 modem is manufactured of non-nutrient materials with respect to fungal growth.

Shipping

The GSP-1620 modem as packaged for shipment meets the pre-shipment test procedures specified in the National Safe Transit Association, Project 1A.

Dielectric Resonator Antenna (DRA) Environments

Since the GSP-1620 Dielectric Resonator Antenna (DRA) communicates with Globalstar satellites, it must be positioned outdoors where it has a clear view of the sky.

As a result, environments affecting the DRA include temperature/humidity, thermal radiation, icing/freezing rain/snow, altitude, vibration, and mechanical shock. This section also discusses RF connector durability, materials, and shipping.

Temperature/Humidity

Operational

The DRA operates as specified during exposure to the operational temperature/humidity envelope shown in Figure 6-3.

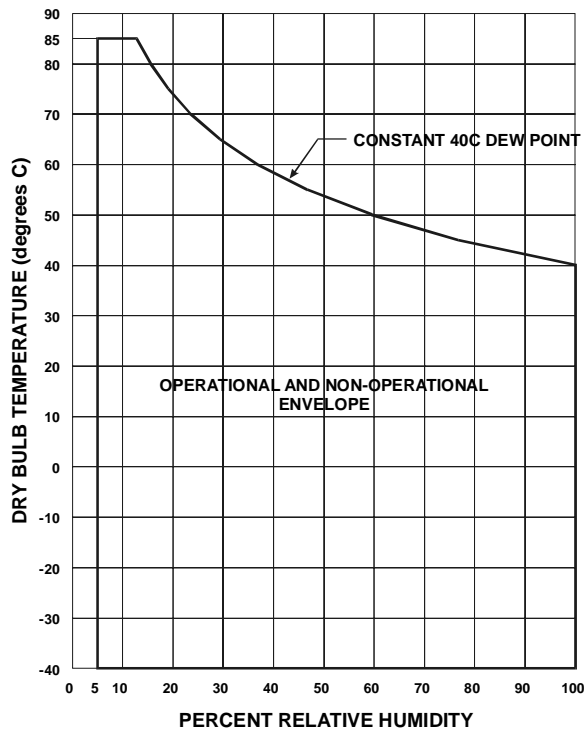
Non-Operational

The DRA operates as specified after exposure to the operational and non-operational temperature/humidity envelopes shown in Figure 6-3.

Thermal Radiation

The temperature profile shown in Figure 6-3 includes temperature rise due to thermal radiation, solar radiation, and other heat loads.

Figure 6-3 DRA Temperature/Humidity Envelope



Icing/Freezing Rain/Snow

Any ice or freezing rain on the radome of the ODU will cause degraded performance. Steps must be taken to ensure that ice formation is kept to a minimum on the ODU.

Globalstar frequencies are attenuated by wet ice and snow and OEMs must make provisions (such as installing the antenna on a pole) to prevent snow buildup on the antenna. Wet ice/snow must be restricted to a maximum thickness of 20 centimeters (8 inches) by suitably mounting the antenna (see *Mounting Antennas at the Field Site* on page 5-21).

Altitude

Operational

The DRA operates at standard atmospheric pressure altitudes between 0 and 15,000 meters (50,000 feet).

Non-Operational

The DRA operates as specified after storage at pressure altitudes ranging from 0 to 15,000 meters (50,000 feet).

Vibration

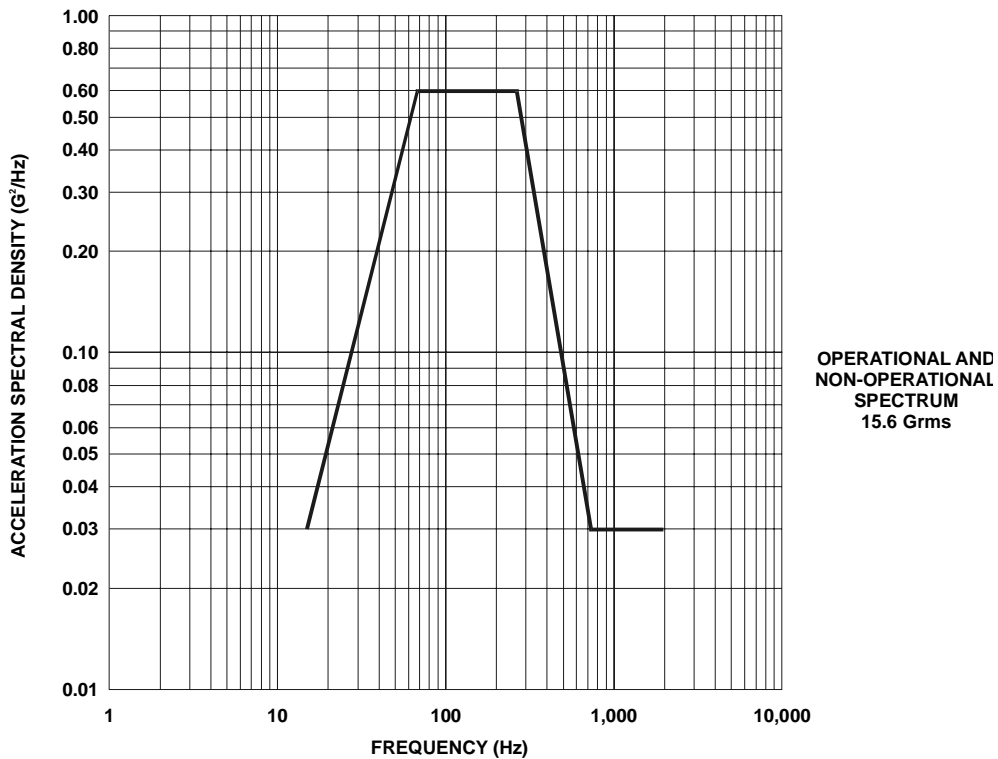
Operational - Random

The DRA operates as specified during exposure to the random vibration spectrum defined in Figure 6-4.

Non-Operational - Random

The DRA operates as specified after exposure to the random vibration spectrum defined in Figure 6-4.

Figure 6-4 DRA Random Vibration Spectrum



Mechanical Shock

Operational

The DRA operates as specified while being subjected to a half sine pulsed acceleration waveform of 6 milliseconds in duration, 30 Gs peak.

Non-Operational

The DRA operates as specified after being subjected to a half sine pulsed acceleration waveform of 6 milliseconds in duration, 100 Gs peak.

RF Connector Durability

The DRA RF connectors meet all performance requirements after 500 connect/disconnect cycles at a maximum rate of 12 cycles per minute.

Materials

The DRA is manufactured of non-nutrient materials with respect to fungal growth.

Shipping

The DRA as packaged for shipment meets the pre-shipment test procedures specified in the National Safe Transit Association, Project 1A.

7 RF Certification/Restrictions

This chapter discusses certification compliance for the QUALCOMM Globalstar GSP-1620 Satellite Data Modem as well as restrictions relating to RF, RF exposure, and electronic devices.

Certification

The QUALCOMM Globalstar GSP-1620 Satellite Data Modem, antenna, and cabling as supplied by QUALCOMM Incorporated shall be compliant with the following International standards when configured in accordance with the QUALCOMM recommendations. Any deviation from the guidelines or modifications to the product performed without the permission of QUALCOMM Incorporated will invalidate all regulatory approvals.

Compliance to the technical requirements shall be demonstrated with the product installed in a non-metallic enclosure, which provides no additional shielding or RF protection. An OEM-supplied enclosure is required to protect the product from the effects of electrostatic discharge (ESD) and environmental conditions that result in the product operating within its specified range.

Compliance to the technical requirements shall be demonstrated with the product powered by a power supply that is compliant with the rules and regulations of the FCC and the European Community. The OEM manufacturer is required to provide a power supply that ensures the product continues to meet the applicable regulatory requirements for the specific application.

QUALCOMM Incorporated does not accept any responsibility for regulatory compliance of the OEM product. It is the responsibility of the OEM manufacturer to ensure that all regulatory requirements (e.g., FAA, Hazardous Location) have been met for the specific application.

Federal Communications Commission (FCC)

The GSP-1620 modem configured with the QUALCOMM-supplied antenna and RF cabling is compliant and approved in accordance with the FCC Code of Federal Rules (CFR) 47 parts:

- Part 1 Para 1.1310 Radio Frequency Radiation Exposure Limits
- Part 15 Radio Frequency Devices
- Part 25 Satellite Communications

European R&TTE Directive 1999/5/EC

The GSP-1620 modem configured with the QUALCOMM-supplied antenna and RF cabling is compliant and approved in accordance with the essential requirements of the European Community, under European Directive 1999/5/EC On Radio Equipment & Telecommunications Terminal Equipment (R&TTE Directive).

The supporting technical standards used to demonstrate compliance are:

- EN 300 831 Electromagnetic Compatibility
- EN 301 441 (TBR 041) Essential Terminal Requirements

RF Restrictions

The GSP-1620 modem must be used with the QUALCOMM-provided antenna, and no modification to the RF transmit or receive path is permitted in the form of amplifiers.

QUALCOMM Incorporated must be consulted before any changes can be made in the RF path, including cable length deviations from the QUALCOMM-provided or recommended cabling. Failure to do so may result in non-compliance with the Globalstar communications network and Government Radio Regulations.

Radio Astronomy Zones

Radio Astronomy exclusion zones may be blacked out of Globalstar service. The OEM manufacturer should consult with the Globalstar Service Provider to ensure that service is available in the location(s) of the installed OEM product.

GPS Interference Elimination

The modem antenna must be installed a minimum distance of 30 inches from a GPS antenna to ensure compatibility between the two satellite systems.

Radio Frequency Exposure Restrictions

The GSP-1620 modem incorporates a relatively low-power radio transmitter, receiver, and antenna (the DRA). When it is ON it receives and sends radio frequency (RF) signals. In August 1996, the Federal Communications Commission (FCC) adopted RF exposure guidelines with safety levels for portable wireless phones and devices. Those guidelines are consistent with the safety standards previously set by both US and international standards bodies:

- ANSI/IEEE C95.1-1992 Standard [American National Standards Institute / Institute of Electrical and Electronic Engineers]
- NCRP Report 86 (1986) [National Council on Radiation Protection and Measurements]
- ICNIRP (1996) [International Commission on Non-Ionizing Radiation Protection]
- IRPA (1991) [International Radiation Protection Association]

The GSP-1620 modem is designed to comply with the established ANSI, FCC, and international safety standards for safe levels of human exposure to RF energy. Maintaining a minimum line-of-sight separation distance of 21.5 centimeters (8.5 inches) between the transmitting antenna and all personnel will ensure that the General Population/Uncontrolled Exposure maximum permissible exposure (MPE) limits are not exceeded.

This satisfies the MPE limits mandated by the FCC in 47 CFR Ch. 1 (10-1-99 Edition), Part 1, §1.1310 and defined in the ANSI/IEEE C95.1-1992 standard, and also satisfies the more-stringent European and international exposure limit recommendations of IRPA (1991) and ICNIRP (1996).



Caution

The Outdoor Unit (ODU) must be installed in a configuration that ensures a minimum line-of-sight separation distance of 21.5 centimeters (8.5 inches) is maintained at all times between the ODU and any personnel.

Electronic Device Restrictions

Most modern electronic equipment is shielded from RF signals. However, certain electronic equipment may not be shielded against the RF signals from wireless phones and modems.

Pacemakers

The Health Industry Manufacturers Association recommends that a minimum separation distance of 15.24 centimeters (6 inches) be maintained between a handheld wireless phone and a pacemaker to avoid potential interference with the pacemaker.

For a wireless modem, which has a higher power output than a wireless phone, the distance must be increased. For a GSP-1620 modem, a minimum separation distance of 22.67 centimeters (9 inches) should be maintained between the transmitting modem antenna and all pacemakers. These recommendations are consistent with the independent research by and recommendations of Wireless Technology Research, L.L.C.

Persons with pacemakers should follow these guidelines:

- Always keep the modem antenna more than 22.67 centimeters (9 inches) from your pacemaker when the modem is turned ON.
- If you have any reason to suspect that interference is taking place, turn your modem OFF immediately.

Hearing Aids

Some digital wireless phones and other wireless devices (including wireless modems) may interfere with some hearing aids. If interference occurs, you may want to consult your Service Provider (or call QUALCOMM Globalstar Customer Service to discuss alternatives).

Other Medical Devices

If you use any other personal medical device, consult the manufacturer of your device to determine if it is adequately shielded from external RF energy. Your physician may be able to assist you in obtaining this information.

Do not operate your GSP-1620 modem (that is, turn your modem OFF) in health care facilities when any regulations posted in these areas instruct wireless phone users to do so. Hospitals or health care facilities may be using equipment that could be sensitive to external RF energy.

8 Modem Integrator's Kit

QUALCOMM offers a GSP-1620 Modem Integrator's Kit (MIK) to assist OEMs in rapid development of user applications for GSP-1620 Satellite Data Modems.

Kit Components

Table 8-1 shows the items contained in the GSP-1620 Modem Integrator's Kit (QUALCOMM part number: MCN 65-82317-1).

Table 8-1. Checklist of Modem Integrator's Kit Components



 Component
QUALCOMM Globalstar GSP-1620 Satellite Data Modem
Dielectric Resonating Antenna (DRA)
Pair of antenna cables with connectors (for quick bench setup of the kit modem)
Custom DB-25 cable bridle, which splits out the DE-9 Data Port connector, the DE-9 Control Port connector, and the DC power leads (positive, negative, and reset)
Diagnostic port cable, for service-programming the modem or to use as alternate power source via its AC adapter
<p>GSP-1620 modem CD-ROM containing the following:</p> <ul style="list-style-type: none">■ Software code samples for modem applications■ A "soft copy" (PDF file) of the <i>QUALCOMM Globalstar GSP-1620 Satellite Data Modem Integrator's Reference Manual</i>, 80-99208-1■ "CDMA by QUALCOMM" logo in an Encapsulated PostScript (EPS) file■ A "soft copy" (PDF file) of the <i>QUALCOMM Globalstar Data User Guide</i>, 80-99126-1EN, as a guide for the setup of a Windows modem driver and Windows Dial-Up Networking.

Table 8-1. Checklist of Modem Integrator's Kit Components

 Component
Globalstar UT Program Support Tool (UTPST), including: <ul style="list-style-type: none">■ CD-ROM containing the UTPST software and a “soft copy” (PDF file) of the <i>Globalstar UTPST Script API Reference Manual</i>, 80-99114-1■ <i>Globalstar UT Program Support Tool User's Guide</i>, 80-98225-1■ <i>Globalstar User Terminal Service Programming Guide</i>, 80-98482-1

What You May Need in Addition to the Kit

The Modem Integrator's Kit should be sufficient for setting up one modem on a bench for development and testing.

For GSP-1620 modem development purposes (bench setup and developing modem applications), it is recommended that developers have a Windows PC, because the Modem Integrator's Kit CD-ROM contains some Windows code samples.

If necessary, the modem can be powered via the AC adapter on the Diagnostic cable, but developers/OEMs may prefer to use their own DC power supply. Mounting a bench modem and antenna is optional, but would require M3 and M4 screws, respectively, and a screwdriver.

OEMs who are packaging modems into end-user products will need to supply mounting enclosures and customized cables.

Configuration and setup of computer systems to use the GSP-1620 modem with Point-to-Point Protocol (PPP) is beyond the scope of this document. However, the configuration procedures for the QUALCOMM Globalstar GSP-1600 Tri-Mode Phone are included as a reference in the *QUALCOMM Globalstar Data User Guide*, 80-99126-1EN (located on the kit's CD-ROM). For example, using the procedures in that document, you can set up a Windows modem driver and Windows Dial-Up Networking. With the

proper DNS addresses from your Service Provider (SP) or Internet Service Provider (ISP), you can access the Internet using the GSP-1620 modem via the Globalstar satellite system.

9 *Warranty*

The warranty for the QUALCOMM Globalstar GSP-1620 Satellite Data Modem and GSP-1620 Modem Integrator's Kit (MIK) will be as provided for in the Supply Agreement.

10 Product Support

This appendix provides support information for the QUALCOMM Globalstar GSP-1620 Satellite Data Modem hardware and software. It contains a description of the support available from QUALCOMM Globalstar Customer Service and how to contact the Technical Support and Order Fulfillment teams.

QUALCOMM Globalstar Customer Service

The QUALCOMM Globalstar Customer Service Center, located in the United States, provides skilled Technical Support and Order Fulfillment staff to support customers with technical issues, purchase order requests, and Return Material Authorizations (RMA) for QUALCOMM-warranted equipment. The QUALCOMM Customer Service Website provides online information and forms for technical support and RMA requests. See *Contacting QUALCOMM Customer Service* on page 10-3 for details.

Technical Support Information

QUALCOMM Customer Service Technical Support is available 24 hours per day, every day, to provide troubleshooting assistance for all QUALCOMM-provided Globalstar products. Technical Support creates a case to track each issue or request and works to provide a resolution. For more information on technical support, refer to Data Modem Troubleshooting information on the QUALCOMM Customer Service Website.

Contact Technical Support for any Satellite Data Modem related issue, including when you need to:

- Troubleshoot a problem.
- Inquire about a software or hardware upgrade.
- Report a documentation issue.
- Request a Return Material Authorization (RMA).
- Find out the status of a technical issue or of an RMA.
- Follow a procedure that requires Technical Support direction.

Prior to contacting Technical Support, please do the following:

- Repeat the steps or procedures to resolve the problem.
- Check the Website and documentation for solutions.
- Identify the software version and hardware version.
- Document steps or procedures taken.
- Prepare to describe the problem in detail.

Order Fulfillment Information

QUALCOMM Customer Service Order Fulfillment is available between 8 a.m. and 5 p.m. Pacific Time, Monday through Friday, for Return Material Authorization (RMA) assistance on QUALCOMM equipment and to request a purchase order. To repair, replace, or upgrade parts, request an RMA from QUALCOMM. Submit RMA requests to Technical Support to create a case to track the request. Technical Support approves RMA requests, and Order Fulfillment validates the warranty and processes the RMA. For more information on the RMA process, refer to RMA information on the QUALCOMM Customer Service Website.

Customer Service Website Information

The QUALCOMM Customer Service Website is located at <http://www.gstechsupport.qualcomm.com>.

Only registered customers may use the QUALCOMM Customer Service Website. For details on registering, go to the login page of the Website, click “Website Registration,” then follow the instructions to become a registered user.

The QUALCOMM Globalstar Customer Service Website provides several resources including the following:

- Product information for the Satellite Data Modem
- Frequently asked questions
- Troubleshooting information
- Forms for technical support requests to submit a case electronically
- Forms for RMA requests to submit a case electronically

Contacting QUALCOMM Customer Service

QUALCOMM Globalstar Customer Service is located in the United States and may be contacted via the Website, phone, email, or facsimile (FAX). Skilled staff are available to assist with technical issues and Return Material Authorizations (RMA) processing for QUALCOMM equipment.

Technical support personnel are available 24 hours per day, every day. Order Fulfillment personnel are available between 8 a.m. and 5 p.m. Pacific Time, Monday through Friday, to process RMA and purchase order requests. A case number is assigned to track each technical issue or request.

Contact information

- Website

The following Website address is available to registered users. Forms are available for submitting Technical Support issues and RMA requests.

<http://www.gstechsupport.qualcomm.com>

- Phone

+1 858 651 4911

- ❑ Select 1 for Globalstar Gateway Products.
- ❑ Select the appropriate option for RMA or Technical Support troubleshooting assistance.

- Email

The following email addresses are available to registered customers.

- ❑ **gstechsupport@qualcomm.com**

Submit technical support issues and RMA requests to this email address. Be sure to provide your name, company, location, telephone number, description of the problem, part information, and details about the error messages and/or log information.

- ❑ **status.techsupport@qualcomm.com**

Obtain information on the status of an existing technical case by sending an email to this address. Be sure to include the case number in the subject line in the following format *Case Number:12345*.

- ❑ **status.rma@qualcomm.com**

Obtain information on the status of an existing RMA case request by sending an email to this address. Be sure to include the case number and the RMA number, if available, in the subject line in the following format *Case Number:12345 RMA Number:67890*.

The following email address is available to all customers.

- **gs.modules.info@qualcomm.com**

Obtain answers for all product information questions by sending an email to this address.

- Facsimile (FAX)

+1 858 651 2345

Submit technical support issues and new RMA requests to this facsimile number. Be sure to provide your name, company, location, telephone number, description of the problem, part information, and details about the error messages and/or log information.

A Specification Summary

This appendix summarizes the specifications for the QUALCOMM Globalstar GSP-1620 Satellite Data Modem and its Dielectric Resonator Antenna (DRA).

For further discussion of hardware issues, see Chapter 5, *Hardware Description*.

Table A-1. Specification Summary — GSP-1620 Modem

Operating Frequencies	Transmit: Receive:	1610-1625 MHz 2484-2499 MHz		
Maximum Transmit Power	+26 dBm EIRP (0.4 W)			
DC Input Voltage	+5.6 V to + 16 V			
Power Consumption Estimates @ 12V Input	State Shutdown Standby Transmit	Min 1.2 mW 280 mW 3.6 W	Typical 2.4 mW 500 mW 4.8 W	Max 6 mW 2.4 W 5.4 W
Interfaces:				
User Port	DB25 Serial RS-232 with pin-outs for data, control, and power			
Modem Antenna Connectors	TX MCX Female RX MCX Female			
Antenna Connectors	TX SMA Female RX SMA Female			
Provisioning and Software Upgrade	DE9 Connector			
Modem Dimensions	190 x 75 x 17 mm (7.48 x 2.95 x 0.68 in)			
Modem Weight	Less than 180 grams (6.3 ounces)			
Antenna (included)	103 mm (4.1 in) diameter by 63 mm (2.5 in) tall Estimated weight is less than 250 grams (8.8 ounces)			
Antenna Cable (not included)	Two cables required: transmit and receive Male SMA to Male MCX Transmit cable maximum 0.6 dB insertion loss @ 1618 MHz Receive cable maximum 3.0 dB insertion loss @ 2492 MHz			

Specification Summary

Table A-1. Specification Summary — GSP-1620 Modem (continued)

Certification	FCC CE
Modem Environmental Conditions	<p>Operating: -30 °C to +60 °C Storage: -40 °C to +85 °C Relative Humidity: 5% to 95% (under 40 °C)</p> <p>The data modem is sensitive to very high ambient noise levels. Steps must be taken to ensure that the noise level at the modem does not exceed 110 dB OSPL (Overall Sound Pressure Level).</p> <p>Shock mounts must be used when the environment includes excessive vibration. The GSP-1620 modem will meet or exceed all operational vibration requirements defined in Table 6-1 when E-A-R damping feet (MF-100-UC04-H, black) are used as shock mounts.</p>
Antenna Environmental Conditions	<p>Operating/Storage: -40 °C to +85 °C Relative Humidity: 5% to 100% (under 40 °C)</p> <p>Signal fading associated with trees, buildings, and other obstacles that prevent a clear line-of-sight to the satellite can cause degraded operation.</p> <p>Any ice or freezing rain on the radome of the Outdoor Unit (ODU) will cause degraded performance. Steps must be taken to ensure that ice formation is kept to a minimum on the ODU.</p>
Supporting Products	GSP-1620 Modem Integrator's Kit (MIK) Globalstar User Terminal Program Support Tool (UTPST) (modem provisioning tool)

Table A-2. Specification Summary — Dielectric Resonator Antenna (DRA)

Parameter	TX Specification	RX Specification
Frequency Range (MHz)	1610.0-1626.5	2483.5-2500.0
Polarization	LHCP	LHCP
VSWR (50 ohm)	<2.0:1	<2.0:1
Isolation (TX→RX) (dB)	>40	>0
Maximum Gain (0°<θ<80°) (dBic) [1]	< 6.5	—

Table A-2. Specification Summary — Dielectric Resonator Antenna (DRA) (continued)

Parameter	TX Specification	RX Specification
Average Gain ($0^\circ < \theta < 80^\circ$) (dBic)	>1.5	>1.5 (passive antenna)
Minimum Gain ($0^\circ < \theta < 80^\circ$) (dBic)	>-4.0	>-4.0 (passive antenna)
Maximum Axial Ratio @ zenith (dB)	<3.0	<3.0
RX LNA/Filter Gain (dB)	–	27 (typical at 25°C)
RX Noise Figure (dB) [2]	–	<2.1
(G/T)avg (dB/K) [3]	–	> -26
(G/T)min (dB/K) [3]	–	> -31
RX Bias DC Voltage (V)	–	+3.6
Rx DC Current (mA)	–	25 (typical)
Power Handling (Watts)	<4	–
Operating Temperature (°C)	-40 to +85	-40 to +85
Altitude (ft)	50,000	50,000
Vibration(Grms) [4]	15.6	15.6
Connector	SMA (F)	SMA (F)
Dimensions	103 mm (4.1 in) diameter by 63 mm (2.5 in) tall	
Weight	< 250 g (8.8 ounces)	

[1] $\theta = 0$ is zenith.

[2] combined LNA and Filter over the operating temperature

[3] at $T_{sky} = 200$ K

[4] random, 3-axis, over 15 – 2000 Hz

Index

A

- acoustic noise 5-15, 6-5
- acquisition 3-4
- agriculture 2-10
- air conditioning 2-9
- airtime 1-4
- alerts, Globalstar service 3-4
- altitude 6-3, 6-9, A-3
- ambient noise A-2
- Analog Microphone Input 5-8
- ANSI/IEEE C95.1-1992 Standard 7-4
- antenna 2-2
 - cables 5-19
 - calculating length 5-21
 - depiction 5-17
 - mounting 5-21
 - multiple 5-23
 - on flat surfaces 5-21
 - on poles 5-22
 - personnel separation distance 7-4
 - sealing 5-21
 - size, weight 5-17
 - specifications 5-16, A-2
- applications
 - host 2-5
 - SCADA 2-5, 2-6
- asynchronous data
 - overview 2-3, 3-6
 - using with packet data 3-13
- AT commands
 - non-operational 4-4

- operational 4-1
- quick reference tables 4-1
- reference section 4-1

- AT\$QCPLS 3-5
- AT\$QCSMSP 3-3
- AT\$QCSTATUS 3-5
- ATMs 2-10
- attenuation, by snow 6-8
- aviation 2-10
- axial ratio, antenna A-3

B

- banking 2-10
- battery-powered applications 5-5
- bent pipe transponders 1-2
- billing 3-2, 3-10
 - records 1-4
- booting up 5-5

C

- cables
 - antenna 5-19
 - length deviations 7-3
 - shields 5-14
 - suppliers 5-20
- calls
 - asynchronous data 3-11
 - packet data 3-7
- canals 2-8
- carriers, Globalstar 1-4
- cathodic protection rectifiers 2-7
- caulking antenna 5-22

- certification compliance 7-1
- CFR 7-2
- Circuit Card Assemblies 2-2, 5-1
- condensation 6-1
- connection time 3-6
- connectors
 - DB-25 5-4
 - digital data durability 6-5
 - Interface 5-7
 - J3 5-1, 5-4
 - J7 5-1, 5-4
 - MCX 5-19
 - modem 5-1
 - modem antenna 5-4
 - RF durability 6-6, 6-11
 - Rx 5-16
 - SMA 5-19, 5-22
 - Tx 5-16
- constellation, Globalstar 1-1
- Control port 5-4
 - line speed 5-4
 - signals 5-5
- coverage 1-2
- CP_signals 5-8
- credit card verification 2-10
- CTS 5-6, 5-9
- Customer Service Center 10-1

D

- damping 5-16, 6-3, 6-4
- data communications equipment, see DCE
- Data port 5-4
 - line speed 5-4
 - signals 5-6
 - transmit rate 3-7, 3-13
- data terminating equipment, see DTE

- DB-25 connector 2-2, 5-4
- DC power
 - impedance 5-10
 - modem requirements 5-10
 - oscillations 5-11
- DC/DC converter 5-10
- DC_signals 5-7
- DCD 5-6
- DCE 4-1
- DE-9 connector 5-9
- degradation of service 3-6
- Diagnostic port 5-9
- Dial Number 3-13
- Dial-Up Networking 3-7
- Dielectric Resonator Antenna, see antenna
- digital
 - board 2-2
 - data connector 6-5
 - ground 5-14
- distributors, User Terminal 1-5
- DNI 5-14
- DNS server 3-11
- dormant mode 3-11
- downconverters 2-2
- DP_signals 5-7
- DRA, see antenna
- DSR 5-5, 5-6
 - asserted 5-5, 5-12
- DTE 4-1
- DTR 5-5, 5-9
 - de-asserted 5-5, 5-13
 - OR'd signals 5-12
 - signal 5-5
- durability
 - digital connector 6-5
 - RF connector 6-6, 6-11
- dynamic IP addressing 3-8, 3-9

E

E-A-R damping feet 5-16, 6-3, 6-4, A-2
electronic device restrictions 7-5
EMI filtering 5-10, 5-11
emissions, 1605 5-23
enclosures 5-15, 7-1
 metallic 5-14
energy management 2-9
environmental specifications
 antenna 6-6, A-2
 modem 6-1, A-2
ESD 5-4, 5-15, 7-1
ETSI 5-11
European
 R&TTE Directive 7-2
 Union 5-14

F

fades 3-4
fatal error 5-6, 5-13
FCC 5-11, 5-14, 7-2
FDX, see full duplex
Federal Communications Commission,
 see FCC
filtering 5-11
firewalls 3-6
fixed IP addressing 3-9
flight plans 2-10
flow rates 2-8
Forward Link 3-1
freezing rain 6-8
frequencies
 antenna range A-2
 modem operating A-1
full duplex 2-4, 3-1, 3-7, 3-13
fungal growth 6-6, 6-11
fuses 5-11

G

GAI 3-1
gain, antenna A-2
gas wells 2-7
Gateways 1-2, 2-5
 IP addressing 3-8
 service areas 3-11, 3-14
geostationary-Earth-orbit satellites 1-2
Globalstar
 Air Interface 3-1
 background information 1-1
 Communications System 2-1
 coverage 1-2
 Customer Service 10-1
 Data User Guide 8-1
 ground segment 1-2
 Limited Partnership (GLP) 1-1
 satellite service 3-1
 service alerts 3-4
 specifications A-1
 UTPST Script API Reference
 Manual xxi, 8-2
 Web page 1-4
GLP 1-1
GND 5-5, 5-6
GPS interference 7-3
ground
 loops 5-14
 segment, Globalstar 1-2
 signal 5-7, 5-8
grounding options 5-14
GSP-1600 Tri-Mode Phone 1-2, 1-5
 LCD screen 3-5
 roaming 3-13
GSP-1620 Satellite Data Modem, see
 modem

H

- hand-offs 3-11
- handshake, TxD/RxD 5-5
- hanging up modem 5-5
- hard reset 5-13
- harvest yields 2-10
- Health Industry Manufacturers Association 7-5
- hearing aids 7-5
- heat loads 6-2, 6-7
- host
 - application 2-5
 - server 3-6, 3-9, 3-11, 3-13
- humidity 6-1, 6-7, A-2
- HVAC 2-9

I

- ice 5-22, 6-8
- ICNIRP (1996) 7-4
- impacts 5-1
- impedance 5-10, 5-11
- IMSI 3-10, 3-11
- interface connector
 - pinouts 5-7
 - summary A-1
- interference, antenna 5-23
- Internet 2-3, 2-5, 3-7
 - Protocol, see IP
- Interworking Function 3-11
- inventory 2-9
- IP addressing 3-8
 - dynamic 3-9
 - fixed 3-9
 - globally routable addresses 3-9
 - private addresses 3-9
- IP-in-IP tunnel 3-10
- IPSec 3-10

- IRPA (1991) 7-4
- IS-95A 3-1
- isolation, antenna 5-23, A-2
- IWF modem 3-11

J

- J3 connector 5-1, 5-4
- J7 connector 5-1, 5-4
- JPM Corporate 5-20

L

- latitude 1-1, 3-5
- LEO satellites 1-1, 2-1, 3-7
- lift station 2-8
- lightning 5-11
- Linux 3-8
- LNA 2-2, A-3
- long distance charges 3-6
- longitude 3-5
- low-Earth-orbit (LEO) satellites 1-1

M

- M3 screws 5-15
- Macintosh OS 3-8
- MCX connectors 2-2, 5-1, 5-4, 5-19
- mechanical shock 6-5, 6-10
- medical devices 7-6
- medium-Earth-orbit satellites 1-2
- MIK, see Modem Integrator's Kit
- Mobile Satellite System 3-1
- modem
 - antenna connectors 5-4
 - banks 3-6
 - board layout 5-1
 - booting up 5-5, 5-12
 - dimensions, weight 5-4
 - distributors 1-5
 - grounding options 5-14

- host 3-6
- IWF 3-11
- mechanical description 5-1
- mounting 5-15
- overview 2-1
- re-booting 5-13
- specification summary A-1
- surge protection 5-11
- training time 3-6
- user interface 5-4
- Modem Integrator's Kit 8-1
- modes, power 5-12
- MODULE_RESET_N 5-5, 5-9
- mounting
 - antennas 5-21
 - modems 5-15
- MPE 7-4
- MSS 3-1
- mud flow 2-7

N

- National Safe Transit Association 6-6, 6-11
- NCRP Report 86 7-4
- networking software 3-7
- nodding donkey rig 2-7
- noise
 - ambient A-2
 - Rx A-3
- noisy lines 3-6
- non-volatile memory 5-13

O

- ODU 2-2
 - see also antenna
- OEMs 1-5
- offshore platforms 2-7

- oil wells 2-7
- operating systems 3-8
- O-rings 5-21
- oscillations, power line 5-10, 5-11
- OSPL 5-15, 6-5, A-2
- Outdoor Unit, see ODU
- Overall Sound Pressure Level 5-15, 6-5
- overhead 3-6

P

- pacemakers 7-5
- packet data
 - overview 2-3, 3-6
 - roaming 3-10
 - using 3-7
 - with asynchronous data 3-13
- parity 5-4
- particulates 5-1, 5-15
- pinouts 5-7
- pipelines 2-7, 2-8
- polarization, antenna A-2
- pole-mounting antennas 5-22
- ports
 - configuration and SMS 3-3
 - see also Control port, Data port, Diagnostic port
 - using Data and Control 3-2
- Position Location Determination 3-5
- POWER 5-10
- power
 - consumption 5-12, A-1
 - DC requirements 5-10
 - ground 5-14
 - handling, antenna A-3
 - maximum transmit A-1
 - modes 5-12
 - on/off 5-5, 5-12, 5-13

PPP

- session 3-7
- with asynchronous data 3-13

precipitation 5-1, 5-15

product support 10-1

PROGRAM 5-10

protocol stacks 3-8

provisioning A-1

PSTN 2-3, 2-5, 3-6

Public Switched Telephone Network, see
PSTN

pumping stations 2-8

Q**QUALCOMM**

- mark on enclosures 5-16

R

R&TTE Directive 7-2

R216, R217 5-14

Radio Astronomy exclusion zones 7-3

reboot 5-6

receive section, antenna 5-16

registration, Gateway 3-11

remote inventory management 2-9

resetting modem 5-13

resistors 5-14

retail transactions 2-10

Reverse Link 3-1

RF

- board 2-2
- certification 7-1
- connector durability 6-6, 6-11
- connector ground 5-14
- exposure guidelines 7-3
- path changes 7-3
- power amp 2-2
- restrictions 7-1, 7-3

RFC 1661, 1662 3-8

Ring Indicator (RI) 5-6

roaming

- asynchronous 3-13
- between Gateway service
areas 3-14
- fixed IP addresses 3-10
- packet data 3-10
- status 3-4
- within Gateway service areas 3-14

routing asynchronous data 2-3

RS-232

- interfaces 2-4
- ports 3-2

RSSI 3-5

RTS 5-6, 5-9

Rx connector 5-16

RxD 5-5, 5-6, 5-9

S

safety standards 7-4

satellites

- Globalstar 1-1
- MEO/GEO 1-2

SCADA applications 2-5, 2-6

sealing antennas 5-21

security system monitoring 2-9

separation distance 7-4

server

- DNS 3-11
- host 3-6, 3-9, 3-11, 3-13

service

- alerts 3-4
- degradation 3-6
- programming 5-9
 - corrupting 5-13

- providers 1-4
- status message 3-5
- shipping 6-6, 6-11
- shock mounts 5-16, 6-3, 6-4, A-2
- Short Messaging Service, see SMS
- short-circuits 5-4
- shutdown mode 5-12
- signal
 - fading A-2
 - ground 5-14
- sinusoidal 6-3
- SLIP 3-13
- SMA connectors 2-2, 5-19
 - sealing 5-22
- SMS 3-2
 - alerts 3-3
 - AT commands 3-4
 - message field information 3-3
 - mobile-terminated 3-2
 - port configuration 3-3
- snow 5-22, 6-8
- snowpack gauges 2-8
- solar radiation 6-2, 6-7
- solder mask 5-14
- specifications
 - antenna 5-16, A-2
 - antenna cable 5-19
 - environmental 6-1, 6-6
 - modem A-1
 - summary A-1
- spillways 2-8
- stacks 3-8
- standby mode 5-12
- status, checking modem 3-5
- stop bits 5-4
- suppliers, RF cables 5-20
- support, product 10-1

- surge protection 5-11, 5-14
- synthesizers 2-2

T

- TCP/IP 2-3
- TCXO 2-2
- Technical Support 10-1
- temperature 6-1, 6-7
 - antenna A-3
- thermal radiation 6-2, 6-7
- throughput 3-7, 3-13
- Times Microwave Systems 5-20
- traffic channel 3-10
- transmit
 - mode 5-12
 - section, antenna 5-16
- TTL levels 5-9
- Tx connector 5-16
- TxD 5-5, 5-6, 5-9

U

- UNIX computers 3-8
- upconverters 2-2
- user interface, modem 5-4
- User Terminals 1-2
 - distributors 1-5

V

- ventilation 2-9
- vibration 5-15, 6-3, 6-9, A-2, A-3
- video surveillance 2-9
- virtual private network, see VPN
- Volex Inc. 5-20
- voltages, input 5-11, A-1
- VPN 3-6, 3-10
- VSWR A-2

W

- warranty 9-1
- watchdog circuit 5-5
- water treatment plants 2-8
- waterways 2-8
- weather data 2-10
- weight
 - antenna 5-17, A-1, A-3
 - modem 5-4, A-1
- well heads 2-7
- wells, oil and gas 2-7
- Windows computers
 - 95/98/2000 3-8
 - NT 3-8
- Wireless Technology Research,
L.L.C 7-5

Y

- Y-modem 3-13

Z

- Z-modem 3-13